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ABSTRACT

A model project was conducted to demonstrate how Chrysler, in partnership with the education community and the government, could provide technical training to enable displaced workers to contribute to the "H-Body" car launch, to improve their job skills, and to enhance their future employability. The training was conducted on a pilot basis for 2 groups with a total of 18 participants. The major emphasis was placed on the process of developing and testing the retraining model. In planning the model, information was gathered by an advisory committee over a three-month period in 1984 about the occupational requirements for workers performing assembly welding at the plant, the overall atmosphere in which welding would be performed, and the experience and skills of the dislocated workers who would be retrained. The project advisory committee agreed that as a result of pilot training, participants should be able to demonstrate welding-related competencies in a variety of knowledge and "hands-on" skill areas. They then developed the curriculum and chose course materials based on these goals. A total of 280 training hours were to be provided by WeldTech, the Chrysler training school, with an additional 40 hours of onsite followup at the plant. Participants were chosen from long-term displaced workers from Chrysler plants. After participation in the training program, participants showed large gains on post-tests compared to pretests. The workers who successfully completed the program have gone on to welding jobs on the assembly line. In a few cases, workers had to take other jobs because of physical conditions that prevented their success. (Half of this document contains such exhibits as a welding duties/tasks list, project performance objectives, skill forms, tests, sample text material, student evaluation form, and certificate.) (KC)

FINAL TECHNICAL REPORT

THE CHRYSLER-WELDTECH APPROACH TO RETRAINING DISPLACED WORKERS

A Model Project

To Develop Specialized Welding Skills Required for Modern Auto Assembly Operations

ED262231

By

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July 31, 1985

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Title VI of the Civil Rights Act of 1964 states: "No person in the United States shall, on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance." Therefore, the project described herein, as is the case with all other programs and activities receiving financial assistance from the U.S. Department of Education, has been operated in strict compliance with this law.

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FOREWARD

This final report describes the planning and implementation of a model project designed to retrain displaced workers for productive employment in Chrysler Corporation's Sterling Heights Assembly Plant. The plant, which launched operations in September 1984, utilizes a variety of high technology manufacturing techniques in the assembly of its "H-Body" products, the Dodge Lancer and Chrysler LeBaron GTS automobiles.

The training approach described in this report was developed jointly by personnel from Sterling Heights Assembly and the staff of the WeldTech Welding Education Center. WeldTech, a part of Chrysler Learning, Inc., is one of the MoTech Educational Centers which, since 1973 have offered high quality vocational education to the public in addition to providing technical training for employees of Chrysler Corporation.

This report, which I hereby release to the U.S. Department of Education, includes specific results of our pilot training, suggestions to others considering similar training activities for displaced workers and our recommendations for follow-up activities needed to further refine this training model. The information herein reflects the findings of WeldTech Staff and the Project Advisory Committee and no official endorsement by Chrysler Corporation should be inferred.

D. L. Maxwell, Vice President
Chrysler Learning, Inc.

ACKNOWLEDGMENTS

Without the continuing cooperation and support of the Michigan Department of Education, Chrysler Corporation's Sterling Heights Assembly Plant, and the MoTech Educational Centers of Chrysler Institute, this project would not have been possible. In addition, the Project Advisory Committee was extremely valuable in identifying training needs, reviewing curriculum materials, analyzing results of Pilot Group I training, and suggesting improvements for Pilot Group II training. Thanks are also extended to the instructional staff of the WeldTech Welding Education Center who were responsible for conducting the actual training sessions, at WeldTech and at Sterling Heights Assembly. A number of specific individuals are also cited below for their significant contributions to the project. The help provided by the following people, and everyone else who participated, is hereby acknowledged by the authors of this report with appreciation:

- Mr. Brian Brunn, former WeldTech Instructor
- Mr. Pat Clayton, former WeldTech Instructor
- Mr. Richard DiCola, Project Officer
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- Ms. Chris Doan, Personnel Development Administrator
  Sterling Heights Assembly
- Mr. Eugene Jacoby, former Director of Chrysler Institute
- Mr. Dominic Manzi, former Personnel Development Administrator
  Sterling Heights Assembly
- Mr. Donald L. Maxwell, Vice President
  Chrysler Learning, Inc.
- Dr. Mary Reiss, Associate Director of Higher Education Management Services
  Michigan Department of Education
- Mr. Larry Smith, WeldTech Instructor
- Mr. Bob Schneble, Body Shop Area Manager
  Sterling Heights Assembly
- Mr. Stan Stewart, WeldTech Instructor

ABSTRACT

This report documents the methods used and results obtained in a model project conducted to test a private sector approach for retraining displaced workers recalled for jobs in a new Chrysler Corporation automotive assembly plant. The specific purpose of this project was to demonstrate how Chrysler, in partnership with the education community and government, could provide technical training to enable these previously displaced workers to contribute to the "H-Body" launch, improve their own job skills, and enhance their future employability.

After developing the training model via a year-long process of planning, implementation, and evaluation, a number of conclusions are made herein about the approach which was utilized. In addition, based on experience gained, this report contains a number of recommendations which may be helpful to others conducting similar retraining projects and offers some suggested areas for additional future study and testing.

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INTRODUCTION

Funding

The model project, including this final technical report, has been funded through a contract with the Office of Vocational and Adult Education, U.S. Department of Education. Weldtech Welding Education Center, a private vocational school and part of Chrysler Learning, Inc., has been responsible for overseeing the completion of contract tasks, including coordination with the Sterling Heights Assembly Plant, formation of the Project Advisory Committee, developing a customized training curriculum, actually conducting the pilot training and providing follow-up to determine the effectiveness of the training effort. All training participants were Chrysler employees. The total outlay required for this retraining project was almost $150,000, consisting of both the costs for WeldTech to conduct the model training project ($90,000) and the costs of wages, excluding fringe benefits, ($58,320 approx.) for eighteen participants involved in pilot training.

Scope

This project was designed primarily to develop a model for retraining displaced workers. It has focused on the task of determining how best to provide trainees with the technical knowledge and directed "hands-on" practical application necessary to perform specialized welding techniques. The training was conducted on a pilot-basis for two groups with a total of eighteen participants. The major emphasis was placed on the process of developing and testing the retraining model.

The limited number of trainees involved in pilot training and the specific type of welding skills taught may have had a significant impact on the results obtained. Therefore, a test involving a larger number of trainees or a different technical skill area may be necessary to verify the results of this project.

This report is intended only as a summary of the project, with emphasis on the planning, implementation and evaluation of the model. Some information has been omitted or compressed for the sake of brevity. Any reader of this report who would like additional information regarding any aspect of this project should contact Mr. Glen A. Knight, Director of the WeldTech Welding Education Center, by telephone at (313) 267-3369 or by writing to the school at 20201 Hoover Road, Detroit, MI 48205. Any requests for information or questions pertaining to similar retraining activities are welcome.

BACKGROUND

The Changing Business Climate

Significant forces at work in the world economy are forcing U.S. companies to re-examine how they do business. Many observers of current trends believe that our country is slowly turning away from the mass production patterns of the past and moving toward an economy built on specialized high technology production, services, and information exchange. Meanwhile, underdeveloped third-world countries are assuming much of our old mass producer function and other industrial nations, such as Japan and Germany, are gearing up their high technology production to aggressively pursue an increased share of the U.S. market.

Consequently, in this atmosphere of change and increased competition, U.S. companies have responded with a variety of actions - - cutting back on production, phasing out obsolete plants, and consolidating operations - - all of which have led to numerous plant closings and massive employee layoffs during the 1980's. The resulting dilemma of worker displacement is, therefore, not due to a temporary business cycle but to fundamental business shifts.

To increase productivity, many companies and unions are starting to totally re-think the production process. Long-held assumptions about production methods, worker training, and even labor-management relations are being questioned. One very significant result is that a partnership between managment and labor, is now seen as a necessary prerequisite for increasing quality and productivity.

Labor's role is also changing in other important ways. A more effective utilization of advanced technology tends to be seen in conjunction with a more flexible application of human resources. In borrowing successful Japanese and European approaches, U.S. companies and unions are attempting to define job classifications in a broader, more generic fashion. Workers are now being cross-trained in several skill areas and are rotated more frequently from one task to another. To meet these changing production demands, supervisors, union personnel, and plant management are adopting new workteam roles.

Such changes are occurring even in business sectors where traditions have been established over many years, such as in auto and steel. A consensus of opinion regarding these changes seems to be emerging, which includes the following concepts:

* New production processes require continued labor-management cooperation and recognition that teamwork is a necessity.
* Retraining personnel at all levels is a vital component during the transition to high technology production techniques.

* Vocational training institutions in the private and public sectors have an important role in helping companies cope with technological change. However, innovative, more efficient methods for working with employers are needed to make this type of interaction between business and education successful.

Need for a Training Model

The rapid advances of technology in the workplace have increased business productivity dramatically. Yet, these emerging technologies have also created the human dilemma of "Displaced Workers", those individuals with stable employment histories who find their jobs eliminated and their present skills out-of-date or insufficient to qualify them for newly created job opportunities. Thus, the retraining of these "Displaced Workers" has become a national priority.

Unfortunately, there are few prototypes which would seem adequate to be used as national retraining models. Therefore, a need has existed to develop such a model to demonstrate how the business/industry private sector, in partnership with public agencies and the education community, may successfully undertake such a retraining effort for "Displaced Workers" to restore their immediate value to employers and enhance their future employability in the labor market. This model would:

1) Develop a process for identifying those skill competencies required to adjust traditional work techniques to demands of the technology found in new workplaces.

2) Develop a process for adapting traditional educational materials and techniques, to instruct workers in the job skills to be used in the new workplaces.

3) Implement training using a small pilot group of trainees to evaluate and refine the model for use on a national scale in other retraining efforts.

Project Organization/Procedures

In 1983, Chrysler Corporation purchased an assembly plant at Van Dyke and 16 Mile Road in Sterling Heights, Michigan, from Volkswagen of America. Chrysler's plans were to use this facility for building a new "H-Body" automobile beginning in the fall of 1984. The plant's goal, as expressed in their first employee newsletter, was "to be first in world automotive assembly technology and quality, utilizing the latest concepts in employee participation/involvement, automation, and design technique." (For additional description of the facility, see "Exhibit A" - Welcome to Chrysler Corporation's Sterling Heights Assembly Plant".)

To provide sufficient plant manpower, Chrysler Corporation recalled displaced workers in a closed-plant pool from a number of different Chrysler plants. Many of these individuals had been unemployed for a substantial period of time. Their individual corporate work histories reflected a wide range of applicable types and levels of job skills.

The manufacturing processes and equipment to be utilized would require higher technical skill levels from Sterling Heights personnel than had ever before been required of employees in a Chrysler assembly plant. Clearly, then, the need for training and retraining was critical to the launch and successful operation of this entire venture.

In this context, discussions between Chrysler Learning, Inc., and the U. S. Department of Education were initiated which resulted in a contract to implement a model training project for displaced workers at the Sterling Heights Assembly Plant. Chrysler Learning, Inc.'s, WeldTech Welding Education Center was identified for participation on the basis of its on-going plant training experience, as well as its status as a licensed, proprietary school.

Several discussions between WeldTech and supervisory personnel from the Sterling Heights Assembly Plant served to focus the project on the need to provide welding skills training to production workers classified at that time as "Quality Operators" in the Body-in-White area. The concept was that Quality Operators would be cross-trained in a number of small parts assembly, body handling, welding and metal-finishing skills in anticipation of rotational work assignments at the plant.

In particular, Quality Operators would need to master advanced welding techniques for flux cored arc welding, MIG brazing, and working with zinc-coated metals. Other areas of particular concern were welding safety, familiarization with welding equipment, weld tip changing/dressing, and other preventive maintenance tasks that the plant would have Quality Operators perform as part of their welding tasks. Since, in conventional assembly plants, preventive maintenance on welding equipment is not done by production workers, this was to be a completely new area in which Quality Operators would need to become proficient.

Sterling Launch Training

As part of Chrysler's launch plan, the Sterling Heights Assembly Plant conducted a massive orientation and education program to familiarize its personnel with the state-of-the-art technology that "H-body" production would demand. By the September 10, 1984 launch, the plant workforce of approximately 1800 salaried and hourly employees would receive close to 900,000 hours of very specialized training, in such subject areas as robotics, programmable controllers, weld controls, paint building systems, and conveyor systems. Other instructional time was spent on orientaton, performance feedback training, interactive management, vendor training, on-the-job training, and classroom training aimed at specific production operations. In addition, a pre-production pilot

program would utilize 125 H-body units in various plant departments for training purposes, as well as to verify the manufacturing process, try out major equipment/facilities, and certify product tooling.

WeldTech Welding Education Center, a part of the Corporation's Chrysler Learning, Inc. training subsidiary would itself provide over 44,000 manhours of welding training for production and maintenance personnel as part of the launch effort. At the time this model project was initiated, a substantial amount of this training was already underway for Sterling Assembly. Therefore, WeldTech's staff was thoroughly familiar with the types of welding required to produce the H-Body products and had gained some prior training experience. This was drawn upon in refining materials and techniques to address specific needs of the displaced workers for which the model would be developed and pilot training provided. Weldtech also had a history of serving the welding training needs of other Chrysler assembly plants including Windsor Assembly, Jefferson Assembly and Belvidere Assembly.

WeldTech Training Experience

WeldTech Welding Education Center was established in 1978 by Chrysler Learning, Inc., as a private tuition school open to the public, to help alleviate the national shortage of qualified welders. The objective of the training conducted at the WeldTech Welding Education Center is to prepare students for entry-level positions in the field of welding, by providing them with an appropriate background in theory and hands-on skill peformance.

The WeldTech curriculum has been designed to utilize a performance-based training approach. In other words, each student is required to perform a number of skill tasks according to recognized industry specifications in this occupational area. All students are continually monitored to ensure that they demonstrate satisfactory progress through the achievement of curriculum objectives relating to welding theory and skill performance. Students are also evaluated on the basis of such factors as attendance, safety habits, use of time, care of equipment, use of materials, manual desterity, degree of class participation, cooperation with others, and dependability.

WeldTech has eleven separate five-week classes to train students in the following major welding processes: Oxyacetylene Welding, Cutting & Brazing (OAW), Shielded Metal Arc Welding (SMAW), Gas Metal Arc Welding (GMAW), and Gas Tungsten Arc Welding (GTAW). Classes are also offered in Blueprint Reading and Fabrication, Pipe Welding, Maintenance Welding and Flux Core Arc Welding. Instruction includes welding on mild steel, aluminum and stainless steel.

WeldTech offers four distinct career training programs - - Combination Welding, Pipe Arc Welding, Pipe MIG & TIG Welding, and Maintenance Welding. Each program consists of a combination of required classes which consist of from 600 to 840 total training hours. The school normally maintains twelve to fifteen full and part-time instructors, most of whom possess from five to ten years of industrial welding experience, to operate three shifts (five hours each) Monday through Friday throughout the year.

WeldTech occupies a large industrial building located at 20201 Hoover Road near Detroit's north boundary, Eight Mile Road. A total of approximately 20,000 square feet is used to accomodate the shop, classrooms, supply room, lunch area, restrooms and administrative offices. WeldTech has seventy individual welding stations equipped with the latest electric welding units, including 24 MIG stations, 12 TIG stations and 22 various A/C and D/C shielded metal arc welders. Twelve stations are available for oxyacetylene welding, cutting and brazing operations. WeldTech also has a wide variety of miscellaneous welding related equipment including shears, drill press, grinders and weld testing equipment.

Although WeldTech has only operated for seven years as a tuition school, it was built upon a decade of prior experience at Chrysler Learning's Hoover Road Training Center in Detroit, during which time more than 5,000 students trained. The majority of these students were contracted through such government funded manpower development programs as the Comprehensive Employment and Training Act (CETA) of 1973, Michigan Vocational Rehabilitation Services, and from various Chrysler Corporation facilities. (For additional information on the school, see "Exhibit B - 1984-84 Catalog Supplement.")

Role of the Advisory Committee

An Advisory Committee was formed to facilitate the implementation of this model project. The purpose of this group was to insure the fullest participation of all parties involved, including the Sterling Heights Assembly Plant personnel, WeldTech's training staff, and the Michigan Department of Education. As envisioned, functions of the Advisory Committee would include the following:

- Participate in analysis of welding skill requirements in "Quality Operator" job classification.
- Rate importance of required welding skills and/or frequency of performance.
- Determine specific performance criteria for required job skills.
- Assist in structuring program goals and objectives.
- Assist in determining instructional staff, facility, equipment, and learning guide requirements.
- Review all curriculum materials prior to training pilot groups.
- Assist in project evaluation/documentation, including identification of program strengths/weaknesses.

Over the duration of the project, the Advisory Committee met four times - - twice prior to Pilot Group I training, once midway through Pilot Group I training, and once to discuss changes needed prior to the start of Pilot Group II training. Additional meetings and discussions were held on an as-needed basis between Glen Knight, Director of WeldTech, and the Sterling Personnel Development Administrator (Dominic Manzi, and later Chris Doan) to plan and monitor the training effort. The Project Advisory Committee consisted of the following individuals:

- Ms. Chris Doan, Personnel Development Administrator
  Sterling Heights Assembly (Pilot Group II phase)
- Mr. Glen Knight, School Director
  WeldTech Welding Education Center
- Mr. Earl Larremore, Body Shop Area Manager
  Sterling Heights Assembly (Pilot Group II phase)
- Mr. Robert Lynch, Body-In-White Quality Operator
  Sterling Heights Assembly
- Mr. Thomas Lyons, Coordinator of Program Development
  MoTech Educational Centers
- Mr. Dominic Manzi, Personnel Development Administrator
  Sterling Heights Assembly (Pilot Group I phase)
- Mr. Clarence Mitchell, On-Site Union Representative
  Sterling Heights Assembly
- Dr. Mary Reiss, Associate Director of Higher Education Management Services
  Michigan Department of Education
- Mr. Bob Schneble, Body Shop Area Manager
  Sterling Heights Assembly (Pilot Group I phase)

PLANNING THE MODEL

Analysis of Job Tasks/Training Needs

These activities took place over a three-month period from April through June 1984.

Useful information was gathered through a variety of sources, including:

- WeldTech instructors with plant training experience who were also familiar with H-Body engineering drawings and weld techniques that were planned to produce the product at Sterling Assembly provided much initial information.

- WeldTech staff made numerous visits to the plant while it was being readied for production to interview supervisory personnel and examine the planned weld booth area of the body shop.

- WeldTech curriculum materials and other available instructional and engineering resources were reviewed to make a preliminary determination of course materials which would be appropriate for pilot training.

- Meetings with Sterling Assembly supervisory personnel and later with the Project Advisory Committee were held to review the specific training plan developed by WeldTech and to provide additional input.

The main purpose of these activities was to learn as much as possible about the occupational requirements for workers performing assembly welding at the plant. A second purpose was to gain a better perspective of the overall atmosphere of production operations in which welding would be performed. The third vital piece of information needed was a profile of the experience and skills of the dislocated workers who would be retrained under this project.

Briefly, the information gathered on occupational requirements for the assembly welding to be performed included:

1) The assembly welding would be performed in a weld booth through which approximately 72 cars per hour would pass. There would be 38 welders in the booth.

2) It was planned that there would be 15 work stations in the booth, each with a set of 6 - 8 welding tasks per automobile. These welds would include mostly interior welds such as seat brackets, door hinges, engine mounts, and various "safety" welds.

3) All welds would be performed on galvanized sheet metal. This metal has a zinc coating to retard rust. However, the fumes given off during the welding of this coated metal are harmful. This means that a protective suit with helmet and fresh-air supply are necessary. This equipment is bulky and manuevering into the required weld positions while wearing it takes practice. Another problem associated with the thin galvanized metal used is the danger of "burn-through", wherein holes are burned through the metal and/or the protective coating is burned away.

4) The welding processes employed would utilize two different processes, MIG brazing and Flux Cored Arc Welding. These are more complicated techniques than most of the resistance gun-welding long associated with assembly operations. Flux-cored arc welding uses the heat of an arc between a continuous filler metal electrode and the work, as in gas metal arc welding. Mig Brazing is another method of joining metal together, wherein filler metal is applied with a torch, without melting the base metal.

5) It was anticipated that the production welders would also be responsible for the routine maintenance of their equipment. This would be a new area for these workers since it was previously handled by the skilled trades.

To launch production, approximately 1600 hourly production workers would be recalled from the UAW/Chrysler Corporation closed plant pool. During their period of layoff, averaging approximately 4½ years, the assembly skills they previously utilized did not remain contemporary with advancing technology and quality guidelines in the automotive industry. These dislocated workers would need a substantial amount of training prior to product launch to "refresh" their former skills and acquire a number of new ones.

Impact of Changing Job Classifications

One factor that would have a strong influence on training requirements and production methods was the planned changes in job classifications, including the "Quality Operator" concept. This new job classification would incorporate a number of job tasks previously performed under several separate classifications including welding, body finishing, small parts assembly, body handling, etc. The result of consolidating these classifications would be that workers employed under the new classification as "Quality Operators" would need to be cross-trained in those skill areas where they had no prior experience. Most would have no prior welding experience of any kind. Therefore, Quality Operators at the plant received a variety of training prior to product launch, including (as of 9/20/84) the following:

Training Topics	Manhours
Winning Way - 40 Hr. Orientation Training	67,120
Power Train (Diagnostic-Repair) Adv. Technical Trng. Quality Operator	19,120
Welding Training (WeldTech)	6,160
Metal Finishing (MoTech)	3,840
On-Site Welding Training	8,720
On-Site Metal Finishing	3,961
Paint Repair/Painted Body Repair	5,040
Fork Lift Driver's Training (LifTech)	2,112
Metrics-Torque Control Print Reading	3,182
Advanced Techical Trng. (Chrysler Institute) Skilled Trades	107,208
Specialized Equipment Training	17,486
Vendor Training	27,095
On-The-Job Training	660,872
TOTAL TRAINING HOURS	940,684

Determining Course Content

Based on the information gathered relative to occupational requirements, and the anticipated job classifications, the Advisory Committee agreed that as a result of pilot training participants should be able to demonstrate welding-related competencies in a variety of knowledge and "hands-on" skill areas. Specifically, these program goals stated that the successful completer should be able to:

1) Name and define the welding processes utilized by Quality Operators at S.H.A.P. and describe their applications in the Body-In-White production area.

2) Demonstrate an understanding of basic welding concepts/terminology, including joint and weld classification, welding positions, distortion control, metal transfer, and use of shielding gas.

3) Identify the welding equipment items used by Quality Operators at S.H.A.P. and state the purpose and features of each item.

4) Identify and demonstrate proper techniques for adjustment and manipulation of welding equipment used by Quality Operators at S.H.A.P.

5) List and describe specific required safety equipment/procedures associated with safe welding practices that are to be utilized by Quality Operators at S.H.A.P.

6) Identify the general charateristics of quality welds, common weld defects, and AWS specifications for visual inspection of welds.

7) Perform quality fillet welds on uncoated sheet metal (using the Gas Metal Arc Welding process) to make lap and tee joints in all positions.

8) Perform quality fillet welds on coated (galvanized) and uncoated sheet metal (using the Flux-Cored Arc Welding process) to make lap and tee joints in all positions.

9) Perform quality fillet welds on coated (galvanized) sheet metal (using the Pulsed-Arc MIG Brazing process) to make lap joints in all positions.

10) Identify common malfunctions on welding equipment used by Quality Operators at S.H.A.P. and describe associated preventive maintenance procedures to be utilized.

11) Perform minor maintenance tasks on welding equipment used by S.H.A.P. Quality Operators, including nozzle replacement, tip dressing, and tip changing.

12) Demonstrate speed skills in performing quality fillet welds (using both the Flux-Cored Arc Welding and Pulsed-Arc MIG Brazing processes) to simulate all types of welds performed at S.H.A.P. weldbooth stations #1 - #15 by Quality Operators.

13) Perform quality fillet welds at weldbooth stations #1 - #15 and associated minor maintenance tasks on welding equipment on the moving assembly line under actual manufacturing conditions at S.H.A.P.

Other curriculum development activities completed by WeldTech staff at this point were:

* Formulation of a tasks listing for Advisory Committee review. (See "Exhibit C - Welding Duties/Tasks of Quality Operators and Preliminary Training Plan.")
* A list of 29 terminal performance objectives was written stating the conditions, specific performance required, and criteria for determining successful completion. (See "Exhibit D - Model Project Performance Objectives.")

* The standard "WeldTech Skill Forms" used at the school were modified to match the terminal objectives for pilot training. These forms are check-off sheets which indicate accomplishment of enabling tasks and the date on which the instructor observed satisfactory performance of these tasks. (See "Exhibit E - WeldTech Skill Forms.")

* A 40-item written pre/post test and nine related objectives-referenced unit quizzes were also developed to assist in evaluating the effectiveness of pilot training. (A detailed description of evaluation techniques used is presented latter in this report. (See also "Exhibit F - Written Testing.")

Choosing Course Materials

The three books selected as appropriate texts for student use in this course were:

Basic Gas Metal-Arc Welding (WeldTech series in welding) Englewood Cliffs, N.J.: Prentice Hall, Inc., 1983, 122 pages

The WeldTech book is one of a series designed specifically to be used as a workbook for welding training in secondary and post-secondary vocational schools. The content is based upon the recommendations of the American Welding Society. There are objectives for each lesson, illustrations showing the latest welding techniques, written theory/procedures, and a glossary of terms. (See "Exhibit G - Sample Text Material.")

Flux Cored Arc Welding (Hobert Series), Troy, Ohio: Hobart School of Welding Technology, 1977, 63 pages

The Hobart publication is also a workbook which presents a step-by-step explanation of the skills required to weld metal with self-shielded and externally shielded flux core electrode wires.

Other welding texts which proved useful for instructor reference and curriculum development activities included:

Pulsed Spray Welding, Union, N.J.: Airco Welding, 1972, 67 pages

Gas Metal Arc Welding (Hobart Series), Troy, OH: Hobart School of Welding Technology, 1976, 72 pages

Essentials of Welding, By Raymond J. Sacks, Peoria, IL: Bennett PUblishing Company, 1984, pp. 327-423

Several publications issued by the American Welding Society were also used as sources of technical information, including:

Effects of Welding On Health IV, Miami, FL: AWS, 1983, 29 pages

Safety in Welding & Cutting, Miami, FL: AWS, 1973, pp. 25-62

Specification for Welding of Sheet Metal, Miami, FL: AWS, 1980, pg. 7

Welding Inspection, New York, NY: AWS, 1968, pp. 151-157

Welding Zinc-Coated Steel, Miami, FL: AWS, 1972, 131 pages

Practical Training Considerations

The Advisory Committee decided to conduct pilot training for two groups of nine (9) trainees each. Pilot Group I was scheduled to start training on June 11, with Pilot Group II tentatively planned for late 1984/early 1985, possibly to coincide with the

implementation of the second (or "afternoon") production shift. The Advisory Committee decided that WeldTech should provide 280 total training hours (during a seven week period) in connection with this pilot program.

It was recommended that six weeks of training be conducted at the WeldTech Welding Education Center. This training time at the school facility would be divided into approximately 80 training hours each for 1) Introduction to Welding Skills (Gas Metal Arc Welding -Solid Wire), 2) Flux-Cored Arc Welding, and 3) Pulsed-Arc MIG Brazing.

An additional 40 hours of on-site follow-up at the plant (by a qualified WeldTech instructor) would also be provided to ensure that welding theory and skills taught at the school would be properly applied on-the-job. The WeldTech instructor would coach trainees them in the actual workplace situation to assist them with the welding problems presented by awkward body positioning, wearing bulky protective equipment, and coping with the moving assembly line.

When reviewing the training curriculum, the Advisory Committee agreed that the preventive maintenance techniques to be taught by WeldTech should consist primarily of routine repair/replacement items which could be accomplished in a short time period, such as changing the nozzle and tips on the welding guns. It was noted that a further benefit of this type of training is the opportunity it would afford Quality Operators to identify equipment problems early, before they have a chance to adversely affect the quality of a large number of welds.

Another point addressed by the Advisory Committee was reading level difficulty of course materials utilized by WeldTech. It was stressed that WeldTech learning activities would not depend solely upon student reading abilities. Rather, the planned approach would appeal to all the trainee senses through a four-step teaching technique including lectures, demonstration, application practice, and "hands-on" performance testing. WeldTech would read aloud written test questions to any student who was found to be experiencing difficulty with reading comprehension.

Class sessions were scheduled to run from 6:30 am to 3:00 pm (with 1/2 hour for lunch) each training day. The instructor, Mr. Brian Brunn, was scheduled to visit the plant prior to the start of training to familiarize himself with plant welding operations and meet trainees prior to the start of training.

The training start-date was planned so that the last week of training, (in-the-plant) would finish on the Friday before the first week of the pre-production pilot program.

IMPLEMENTING THE MODEL

Trainee Characteristics

Participants for Pilot Groups I and II of this training project were selected by the Personnel Department of Sterling Assembly, in consultation with Body-In-White area supervision. All eighteen of those originally chosen (plus the four later replacements) were individuals who had been displaced from Chrysler plants for a significant period of time (up to five years) before being recalled by Sterling Assembly in early 1984. Since their call-back, they were involved in a variety of orientation and skill training sessions. A list of these individuals was prepared prior to training which included such information as their previous job classification, previous plant location, and last date worked (at previous plant). Many of these individuals were employed at either Chrysler's Hamtramck or Lynch Road Assembly Plants, both of which are now closed..

On the first day of training (in both Pilot Groups I and II) a student background survey was distributed to all students. Students were asked to answer a few questions about their welding experience and turn in the sheet. They were asked not to identify themselves by name. The tabulated results (of the 17 returned) were as follows:

1. Have you ever welded as part of your job duties at Chrysler?

   14 - Yes
   3 - No

2. If yes, at which plant?

   5 - Lynch Road Assembly
   3 - Hamtramck Assembly
   3 - Jefferson Assembly
   1 - Warren Truck
   5 - No Reply

3. For how long?

   2 - ten years
   2 - five to nine years
   3 - one to four years
   1 - Less than 1 year
   9 - No reply

4. What welding task did you perform?

   14 - Spot Welding
   3 - No reply

5. Did you ever receive any formal welding training?

   2 - Yes
   12 - No
   3 - No Reply

6. If yes, what kind?

   1 - Training at Sterling Assembly for two weeks in Flux Core and MIG Brazing.
   1 - Training at Lynch Road

The conclusions drawn from this survey were that participants either had no prior welding experience or only spot (resistance) welding which requires only minimal skill. Prior training had been minimal, therefore, the instructor geared the training to a novice level.

Pilot Group I

Training was conducted for nine participants from June 11, 1984 through July 27, 1984. Mr. Brian Brunn was the WeldTech instructor for the six weeks conducted at WeldTech. Mr. Larry Smith, another WeldTech instructor, conducted the week of in-plant training that followed.

Mr. Brunn reported back to the Advisory Committee on July 11 while training was still in-progress. He was able to report that all students were making adequate progress at that time, as measured by the number of performance objectives completed, scores on written tests, attendance records, and general attitude. He discussed a number of teaching techniques being used at WeldTech to improve the effectiveness of training, such as weekly student skill competitions, practice in assuming various body positions during welding to duplicate job requirements, use of timed skill tests to help increase student speed skills, and qualification of students to AWS and Chrysler weld specificiations.

This last procedure, qualification, involves visual inspection and mechanical bend testing of each trainee's weld samples according to established criteria. Advantages of qualifying trainees are threefold: trainee accomplishments are recognized since they receive a certificate and wallet card attesting to their demonstrated skills, trainees will gain an awareness of the importance of weld quality and integrity of workmanship, and trainees will have an official record of additional skills recognized throughout the various sheet metal industries. The last advantage would become particularly significant, if they were ever displaced again as it would greatly improve their chances for employment in other companies doing similar sheet metal welding.

Mr. Smith reported that during his in-plant portion of the training, students first practiced their welds on scrap cars in an off-line training area for several days. When the pilot production program began, the major problems the trainees experienced were:

1) Difficulty with adjustment to welding the moving vehicles on the assembly line.

2) Additional time was required to gain the necessary coordination in bending, leaning, and stretching motions required to perform needed tasks in many of the weldbooth stations.

3) Becoming accustomed to the bulky protective clothing/air supply equipment used to avoid the toxic fumes given off when welding galvanized metal.

4) Developing the necessary speed skills that would be required when line-speed was increased to normal assembly schedules.

All nine participants completed training successfully and were awarded WeldTech certificates at a plant ceremony on July 27, 1984. Participants were recognized for their performance in remarks made by WeldTech staff and plant supervision, including Mr. F.J. Farmer, Plant Manager.

Preliminary Analysis and Modifications

At the Advisory Committee meeting of December 19, 1984, Mr. Glen Knight and Mr. Tom Lyons reviewed highlights of trainee performance in Pilot Group I, including:

* All nine students showed improvement based on their pre/post test scores.
* Post-test average score of 71% was 44 percentage points improved from pre-test average score of 27%.
* Results on post-test ranged from 43% up to 84% as opposed to pre-test range of 2% to 74%.
* Scores improved (post vs. pre-tests) from 10-80 percentage points.

The Advisory Committee, after discussion, recommended that two major changes should be incorporated into Pilot Group II training, as follows:

* Increase the amount of in-plant training time (during seven-week training period) from one week to two weeks. Five weeks of training would still be conducted at the WeldTech school.
* Provide trainees with the same protective helmets used at SHAP so they might have an opportunity to become accustomed to wearing this equipment and working under the same conditions as found in the plant.

(For a detailed record of the contributions of the Advisory Committee, see "Exhibit H - Minutes of Advisory Committee Meetings".)

Based on later input from Sterling's Body-In-White area supervision (who felt that more than two weeks of training in-plant was required) actual Pilot Group II training at WeldTech was shortened to three weeks, with the remaining four weeks reserved for in-plant coaching of trainees by a WeldTech instructor on the moving assembly line.

Pilot Group II

Chris Doan set up the schedule for Pilot Group II training, as follows:

* Prior to January 7, 1985, SHAP supervision would select nine trainees, who had been displaced from other Chrysler Plants and rehired at Sterling (possessing no prior welding experience or only minimal welding skills).
* Classroom and hands-on training would take place for three weeks at Weldtech, from January 7 through January 25, 1985.
* In-plant coaching under supervision from a WeldTech instructor would take place for four (4) weeks, from January 28 through February 22, 1985.

Due to the reduced amount of training time at WeldTech, it was not possible to complete all course theory material covered with Pilot Group I. Therefore, only quizzes 1 - 6 were administered. In addition, since the pre/post test consisted of questions from all nine unit quizzes, it was not considered appropriate to administer it as a post-test for Pilot Group II.

As a result of performance evaluations at WeldTech and Sterling Assembly, it was determined by the instructor in week four of training, that three of the original nine trainees failed to demonstrate adequate skill progress. (One trainee was 6'8" tall and had difficulty positioning himself properly on the moving line to perform the required welds). Those three trainees were assigned other non-welding work tasks and replaced with three additional trainees (all displaced workers) who were provided with in-plant training for the remainder of the scheduled period. Another trainee, who demonstrated satisfactory progress through Week Four of training, had to withdraw from training to go on a medical leave. He was also replaced with another trainee who was a displaced worker. The end result was nine successfully trained welders who passed all required performance tests were issued certificates denoting satisfactory program completion.

Discussion

Due to the bargaining process in labor negotiations with the UAW, the final contract did not recognize the Quality Operator classification. However, the concept was adopted to the extent that instead of the approximately 120 job titles in effect at a traditional auto-assembly plant, the agreement pares down the number to only nine, as follows:

Classification Title-Other Than Skilled Trades	Maximum Wage Rate
General Services Operator	$ 9.40
Material Control Operator	9.62
Production Operator	9.67
Inspector	9.76
Metal Finisher - Body & Sheet Metal	9.86
Production Repairer - Mechanical & Trim	9.86
Arc & Gas Welder	9.86
Paint Sprayer	9.86
Production Repairer - Paint & Metal	10.15

Welding is now covered under the job classification of "Arc & Gas Welder" at Sterling Assembly. Typically, the trainees were employed under the "Production Operator" classification at $9.67 per hour prior to their WeldTech Training. After completing training, they were upgraded into the "Arc & Gas Welder" classification with a resulting higher pay rate of $9.86 per hour. The official job description for "Arc & Gas Welder" (per the current union agreement) is as follows:

ARC & GAS WELDER

Statement of Job

Performs hand arc and gas production and repair welding and brazing, operates certain automatic shielded arc welding machines and performs variety of soldering work.

Duties

Sets up and operates gas and arc welding equipment to hand weld and braze on production operations and at product repair stations. Welds in horizontal, vertical and overhead positions.

Sets up and operates automatic shielded arc welding machines. Machines are equipped with movable welding heads, use consumable electrodes and special flux and generate higher temperatures than other arc welding machines.

Makes adjustments and minor repairs to equipment and assists skilled trades to correct equipment malfunctions.

Performs variety of work in vehicle assembly solder booths including, but not limited to, cleaning, heating, tinning, and filling depressions with solder.

Seeks defects undetected by other employees. Upon completion of repairs, certifies that required repairs are completed.

Performs various duties and assumes basic responsibilities as set forth in - Basic Responsibilities of All Employees.

Comments

This classification is restricted to Sterling Heights Assembly Plant.

As it pertains to this model project, the main effect of this change in classification which was arrived at through collective bargaining with the UAW, is to eliminate maintenance of welding equipment as a task performed by workers in this classification. Future training for welders in this classification should minimize, if not eliminate, this topic from the training outline.

EVALUATION PROCEDURES

A number of evaluation methods were utilized by WeldTech to ascertain trainee progress in achieving course objectives at the school and in the plant. A listing of each method and its intended purpose follows:

Evaluation Procedure	Purpose of Evaluation
1. PreTest/PostTest	To determine how much trainees have learned as a result of instruction.
2. Quizzes #1-9	To provide feedback to trainees and diagnose individual learning problems in specific portions of the training.
3. Student Attendance & Progress Report	To provide feedback to trainees and diagnose individual behavior/ attitude problems.
4. Skill Achievement Forms	To document that trainee has achieved performance objectives.
5. Welding Certification/Qualification Certificate & Wallet Card (Pilot Group I only)	To certify/qualify trainee to AWS and Chrysler specifications.
6. Student Rating Form	To incorporate trainee feedback into curriculum revision/ improvement process.
7. Student-By-Item Error Matrix (Pilot Group I pre-post test)	To determine written test questions answered incorrectly by each student and to total the number of incorrect answers to each item.
8. Item Analysis Worksheet (Pilot Group I pre-post test)	To determine difficulty level and discrimination power of each test question.
9. In-Plant Instructor Follow-Up/Supervisor Survey	To incorporate feedback from plant supervision into curriculum revision/improvement.

The above methods were used to evaluate five dimensions of the training experience, as follows:

Trainee Technological Knowledge

This aspect was documented by use of the Pre/Post Test and Quizzes #1-9.

Trainee Performance Skills

This aspect was documented through use of the Skill Achievement Forms and the Welding Certification/Qualifications Procedures. Instructors used visual welding inspection, the most widely used and valuable welding inspection technique, to evaluate quality of individual welds. It is a particularly effective method for non-critical welding inspection. In addition to being a weldment inspection technique, it allows inspection of the welding procedures themselves and, thus, is also a preventive tool. Visual inspection throughout the forming of a single weldment can pinpoint problems which might arise through use of faulty materials, defective equipment, or improper welding techniques.

The inspector can note errors in weld preparation, dimensions, alignment, fit-up, cleanliness, welding procedure, warpage, and finish. The inspector can also detect surface slag, roughness, spatter, craters, surface porosity, undercuts, overlaps, cracks, and inadequate penetration.

For the purposes of this training, the WeldTech instructor served as an inspector, following the guidelines set forth in Specification for Welding of Sheet Metal, publication D9.1-80 of the American Welding Society.

As per Section 5, ("Inspection of Work") of that publication, the acceptance criteria for the work was as follows:

5.1 Fusion. Complete joint fusion.

5.2 Penetration. Required joint pentration as specified for the application.

5.3 Reinforcement of Welds in Butt Joints. A maximum of 0.125 in. (3.2mm) face reinforcement and 0.125 in. (3.2 mm) root reinforcement.

5.4 Throat and Convexity of Fillet Welds. A minimum throat equal to the thickness of the thinner member joined with maximum convexity not to exceed 0.125 in. (3.2 mm).

5.5 Porosity. Not more than three visible pores or slag inclusions per inch (25 mm) of weld which are larger than 0.25t and nor more than one visible pore or slag inclusion per inch (25 mm) of weld which is larger than 0.5t, where t is the base metal thickness.

5.6 Undercut. No undercut exceeding 0.15t, where t is the sheet metal thickness being welded, nor exceeding $0.25t_2$, where t_2 is the thickness of the reinforcing member.

5.7 Conformance. Completed welds shall be visually inspected for location, size, and length in accordance with the engineering drawings and specification requirements.

Trainee Attitude

Instructors evaluated this dimension at WeldTech by taking attendance and rating the trainee from 1 - 4 (4 being the best) in four separate areas, namely Industry/Energy, Relations with Others, Learning Ability, and Dependability. Although rather subjective, this information is shared on a weekly interval with the trainee and may serve as a basis for counseling sessions and/or performance reviews. The Student Attendance and Progress Report is used for this purpose.

On-The-Job Performance

This feature is evaluated primarily through first-hand instructor observation and informally surveying supervisory personnel.

Effectiveness of Training Model

A number of instruments are used to arrive at a conclusion in this area, including the Student Rating Form, Student-by-Item Error Matrix, and Item Analysis Worksheet, as well as all of the other evaluation tools previously described in this section.

RESULTS OF TRAINING

PreTest/Post Test

The instrument used for written pre and post testing consisted of 40 items drawn from quizzes 1 through 9 and referenced to the terminal objectives. Test/quiz items consisted of a combination of multiple choice, true-false, and matching questions.

The pre-test was administered to trainees in both Pilot Group I and II prior to their participation in the program. Scores in Pilot Group I ranged from 1 - 30 correct and the class average was 11. Scores in Pilot Group II ranged from 2 - 25 correct and the class average was 17.

The same text was administered to Pilot Group I at the conclusion of training. Scores ranged from 17 - 34 correct and the class average was 28 or an average of 11 more correct than on the pre-test. All trainees improved their scores (from as few as 4 to as many as 32 more correct answers each). The post-test was not administered to Pilot Group II because the time available for classroom training was abbreviated. Consequently, only about 2/3 of the anticipated theory material was presented. Since questions on the pre/post tests were drawn from all 9 unit quizzes, it was decided that the test would not give an accurate measurement of learning gained through training in Pilot Group II.

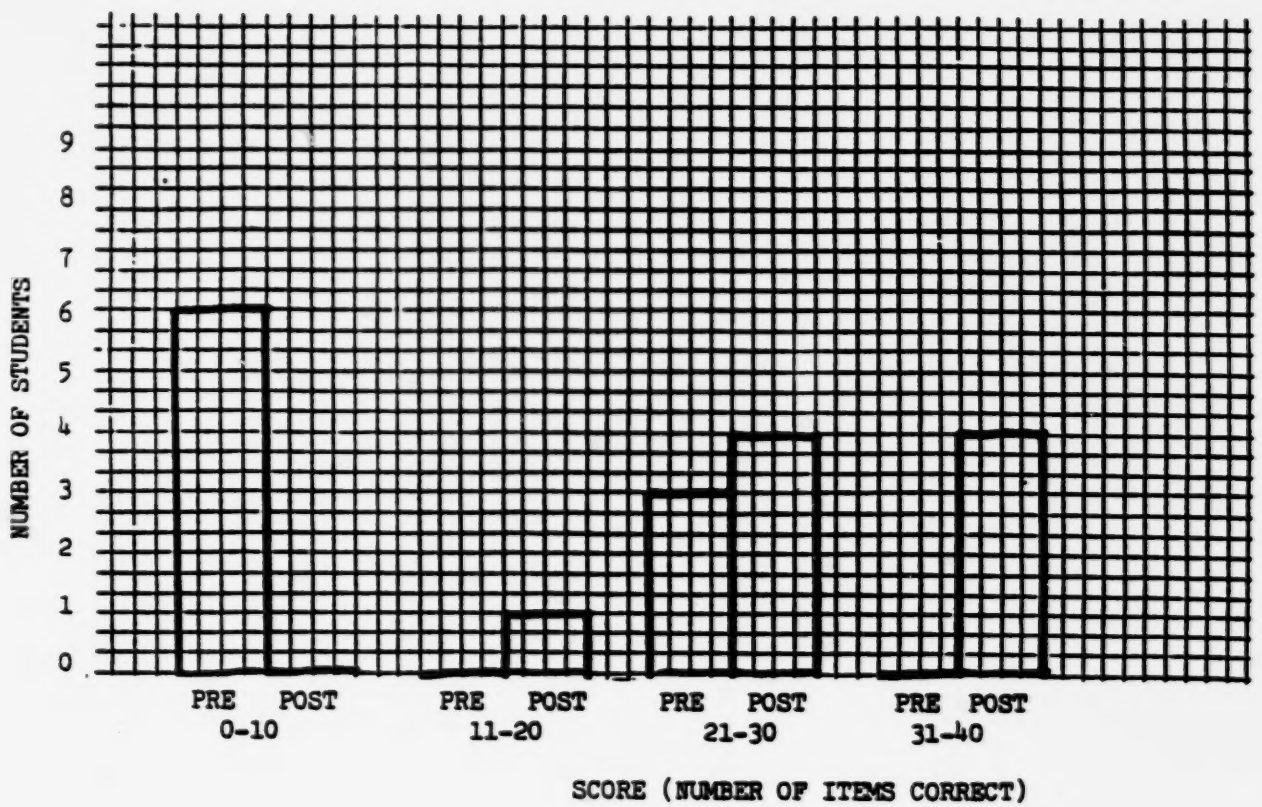
The pre/post test results from Pilot Group I seemed to indicated a substantial increase in technical knowledge due to training participation. In spite of this fact, the total amount of technical information and written testing was decreased in Pilot Group II. This was done at the recommendation of the Project Advisory Committee, in a move to emphasize the in-plant coaching for participants to help them improve their on-the-job skills.

The overall results of the pre- and post-tests for this training program are displayed in the score distribution below. Each bar of this graph represents all scores within a ten-point interval.

SCORE DISTRIBUTIONS FOR PRE & POST TESTS

STERLING WELDING TRAINING FOR DISPLACED WORKERS

JUNE '84 D.O.E. CLASS



On the following pages, data for Group I is presented in a pair of student-by-item error matrices. These more detailed displays permit analysis of the possible "causes" of the overall results observed in the group scores. That is, they help to diagnose problems with individual items and with individual students.

S.H.A.P. WELDING SKILLS TRAINING FOR QUALITY OPERATORS

PRE-TEST (MAXIMUM POSSIBLE SCORE: 40 POINTS)

STUDENT-BY- ITEM ERROR MATRIX

STUDENT NAMES	Test Items 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	TOTAL SCORE	PERCENT CORRECT
1. T.A.		x	x	x		x			x	x			x								x		x	x		x	x			x	x		x			x	x				x	22	55%
2. J.C.	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1	2.5%
3. C.G.		x		x		x		x	x	x			x					x		x			x	x	x		x	x	x	x									x	23	57.5%
4. T.G.	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	2	5%
5. H.H.	x	x	x	x	x	x	x	x	x				x				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	6	15%
6. D.J.	x	x	x	x	x	x	x	x	x	x	x		x					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	5	12.5%
7. G.J.	x	x	x	x	x	x	x	x	x	x		x	x	x					x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	7	17.5%
8. D.S.			x			x		x	x			x							x							x		x		x									x	30	75%
9. E.T.	x	x	x	x	x	x	x	x	x	x	x		x				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				x	7	17.5%
TOTAL ERRORS PER ITEM	6	8	8	8	6	9	6	8	9	7	4	3	8	2	1	2	4	6	7	6	7	6	8	8	7	7	9	7	8	8	8	6	7	6	7	7	4	5	5	9		

S.H.A.P. WELDING SKILLS TRAINING FOR QUALITY OPERATORS

POST TEST - 40 POINTS

STUDENT-BY- ITEM ERROR MATRIX

STUDENT NAMES	Test Items 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	TOTAL SCORE	PERCENT CORRECT
1. T.A.	X			X				X	X								X				X				X		X		X		X									X	29	73%
2. J.C.							X		X								X		X	X		X				X														33	83%
3. C.G.				X		X		X	X										X	X	X	X																		32	80%
4. T.G.						X	X		X	X	X	X	X	X		X		X		X		X	X	X	X		X	X		X	X					X	X	X	X	17	43%
5. H.H.		X		X		X		X						X					X	X	X		X	X		X		X	X		X							X	25	63%
6. D.J.			X	X			X	X	X								X		X		X				X	X		X												29	73%
7. G.J.							X						X	X			X		X	X		X			X	X	X		X	X	X	X		X	X			X	23	58%
8. D.S.				X					X										X		X	X			X														34	85%
9. E.T.									X										X	X		X										X							34	85%
TOTAL ERRORS PER ITEM	1	1	1,5	0	3	4	4	7	1	1	1	2	3	0	1	4	1	7	6	5	6	2	2	2	4	5	3	3	2	4	2	2	0	1	1	1	1	1	1			

In proceeding with an item and student analysis of this information, the following basic points must be kept in mind:

a) The pre- and post-tests are the same test used both before and after training.

b) Each of the nine students in Group I took both tests.

c) Each number along the top of the matrix represents a separate test item.

d) An "X" indicates a student error. Errors are totaled in each column, and total items correct (blank squares) are totaled in each row.

Several items showed essentially no gain, and in one case even a loss, from pre-test to post-test. Items 12, 15 and 16 showed very few errors on either test. Items 17, 19, 20, 22 showed no gain, while items 7, 9, and 21 showed only a marginal gain. Item 14 went from two errors on the pre-test to three on the post-test. Possible explanations for these results are as follows:

Items 12, 15, and 16: Students already knew the material to be taught, or the questions were worded in a manner to give away the answer.

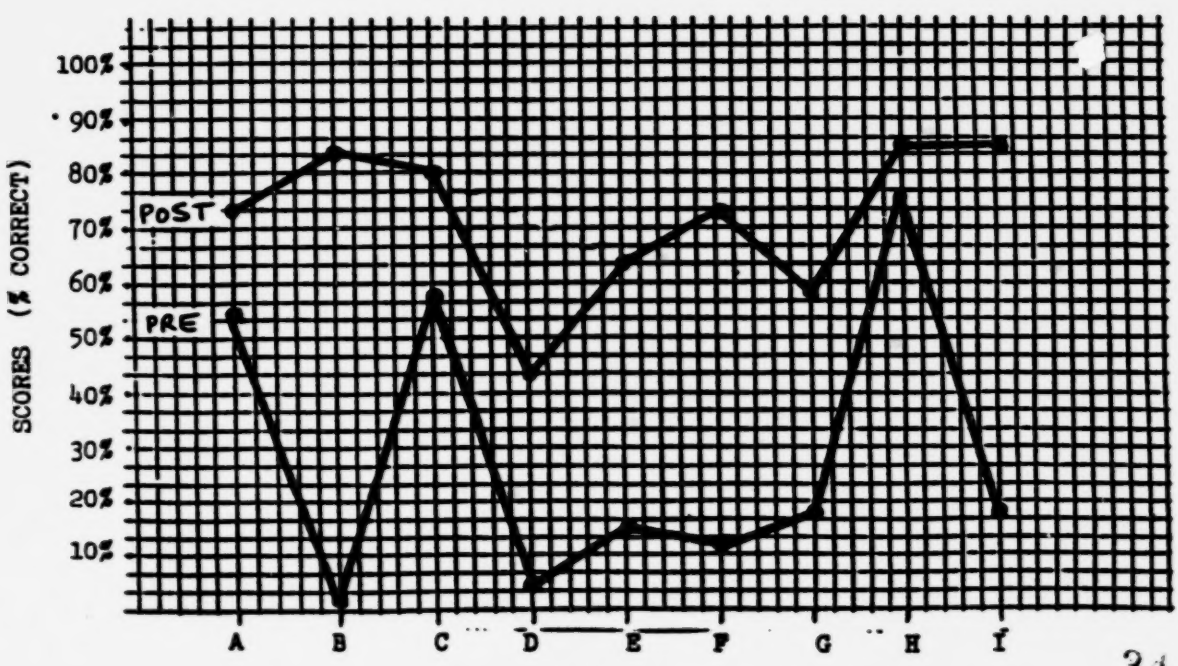
Items 7, 9, 17, 19, 20, 21, 22: May be due to inadequate instruction, or to poor items (e.g. ambiguous, tricky, etc.)

Item 14: The students may have been taught something incorrect, which led to errors.

All of the students showed a gain from the pre-test to the post-test as shown on the graph below:

STERLING WELDING TRAINING FOR DISPLACED WORKERS

JUNE '84 D.O.E. CLASS



On the basis of the post-test scores, students T.G., H.H., and G. J. showed only marginal mastery of the technical concepts/knowledge taught. This, of course, depends on the standards applied, but 60% to 70% is almost universally considered a borderline score. It could also be argued that student D.S. with a pre-test score of 30 (or 75%) did not need the instruction.

Item Analysis

This technique was used to take a critical look at each question on the pre/post test in an effort to determine which were good items, which should be rewritten, and which should be discarded. An item analysis yields two values for each item - the "difficulty level" and the "discrimination power." It involves the comparison of a convenient percentage of the highest and lowest scores on a particular test.

"Difficulty level" is important because items that all students get right or that all students get wrong do not help to distiguish between amounts and levels of student learning. Most educators would agree that a good test should consist of items that vary in difficulty so that it will measure degrees of student learning.

With regard to "Discrimination Power" test items can have either a positive or negative discrimination value. A positive discrimination value indicates that the item was answered correctly more often by the students who scored highest on the test. A negative discrimination value refers to the fact that students who got the lowest scores on the test got the item correct more often than did the students who got the highest scores on the test. Negative discrimination values are undesirable since the goal of any test should be that high test scores are achieved by the students who have learned the most about the subject. The item analysis sheet for Group I pre and post tests is shown on the next two pages.

An item analysis of the pre and post tests indicated that:

1) The test consisted of items of varying degrees of difficulty. Difficulty level decreased from an average of 3.1 on the pre-test to 4.2 on the post-test. Exceptions included items 14, 19, 20, and 22. A level of O indicates greatest difficulty.

2) Discrimination power of items was generally positive. Exceptions were items 6, 9, 12, 27, and 40 on the pre-test which had a discrimination value of O. Post-test exceptions were items 1,3,4,5,15,17,21,32,33,34 which had a discrimination value of O and items 9, 19, and 22 which had a negative discrimination value. The discrimination power dropped from an average of 1.7 on the pre-test to an average of .9 on the post-test. (High positive value indicate postive discrimination).

ITEM ANALYSIS WORKSHEET

TEST PRE-TEST CLASS GROUP I (MODEL PROJECT)

TOTAL STUDENTS 9 NUMBER IN GROUP (H or L) 3

DIRECTIONS: Select a representative number of the highest and lowest test scores and enter the number of each group getting the item correct.
H = Number of high group getting item correct
L = Number of low group getting item correct
H + L = Difficulty level (0 indicates most difficult)
H - L = Discrimination level (high + values indicate positive discrimination)

ITEM NO.	H	L	H + L	H - L	NO.	H	L	H + L	H - L
1	3	0	3	3	26	2	0	2	2
2	1	0	1	1	27	0	0	0	0
3	1	0	1	1	28	2	0	2	2
4	1	0	1	1	29	1	0	1	1
5	3	0	3	3	30	2	0	1	1
6	0	0	0	0	31	1	0	1	1
7	3	0	3	3	32	3	0	3	3
8	2	0	2	2	33	2	0	2	2
9	0	0	0	0	34	3	0	3	3
10	1	0	1	1	35	2	0	2	2
11	3	0	3	3	36	2	0	2	2
12	2	2	4	0	37	3	0	3	3
13	1	0	1	1	38	3	0	3	3
14	3	2	5	1	39	3	0	3	3
15	3	2	5	1	40	3	0	0	0
16	3	1	4	2	41				
17	3	1	4	2	42				
18	2	0	2	2	43				
19	2	0	2	2	44				
20	2	0	2	2	45				
21	2	0	2	2	46				
22	3	0	3	3	47				
23	1	0	1	1	48				
24	1	0	1	1	49				
25	2	0	2	2	50				

COMMENTS: _____

ITEM ANALYSIS WORKSHEET

TEST POST - TEST CLASS GROUP I (MODEL PROJECT)

TOTAL STUDENTS 9 NUMBER IN GROUP (H or L) 3

DIRECTIONS: Select a representative number of the highest and lowest test scores and enter the number of each group getting the item correct.
H = Number of high group getting item correct
L = Number of low group getting item correct
H + L = Difficulty level (0 indicates most difficult)
H - L = Discrimination level (high + values indicate positive discrimination)

ITEM NO.	H	L	H + L	H - L	NO.	H	L	H + L	H - L
1	3	3	6	0	26	2	1	3	1
2	3	2	5	1	27	2	1	3	1
3	3	3	6	0	28	3	0	3	3
4	2	2	4	0	29	3	2	5	1
5	3	3	6	0	30	3	0	3	3
6	3	1	4	2	31	3	0	3	3
7	2	1	3	1	32	2	2	4	0
8	3	2	5	1	33	3	3	6	0
9	0	2	2	-2	34	3	3	6	0
10	3	2	5	1	35	3	2	5	1
11	3	2	5	1	36	3	2	5	1
12	3	2	5	1	37	3	2	5	1
13	3	1	4	2	38	3	2	5	1
14	3	0	3	3	39	3	2	5	1
15	3	3	6	0	40	3	0	3	3
16	3	2	5	1	41				
17	2	2	4	0	42				
18	3	2	5	1	43				
19	0	1	1	-1	44				
20	1	0	1	1	45				
21	2	2	4	0	46				
22	0	1	1	-1	47				
23	0	1	1	-1	48				
24	3	1	4	2	49				
25	3	2	5	1	50				

COMMENTS: _____

As for difficulty, it can be concluded from the item analysis that more students (from both the high and low groups) got the items correct on the post-test, presumably as a result of their training and therefore the questions had a lower difficulty level. The items which reflected a higher difficulty level on the post-test may be as a result of some confusion in the way this material was taught or in how the questions were written.

The fact that the discrimination power of items 1,3,4,5,15,17,21,32,33 and 34 was zero, merely indicates that as many in the low group as in the high group got the item correct. Items 9, 19, and 22 which had negative discrimination power should be carefully reviewed to see if they are ambiguous questions or if they are worded so that the better students read something into them that was not intended.

Quizzes

Another aspect of the testing design was written quizzes to evaluate technical knowledge learned as a result of training. They consisted of 10 - 20 questions each, of the multiple choice, true-false, matching, and completion varieties. The quizzes developed for this project were:

* Quiz #1, "Introduction to Gas Metal Arc Welding"
* Quiz #2, "Safety and Health of Welders"
* Quiz #3, "GMAW Procedures and Equipment"
* Quiz #4, "Theory of Flux-Cored Welding'
* Quiz #5, "Adjustment of Flux-Cored Equipment"
* Quiz #6, "Weld Quality Control"
* Quiz #7, "General Welding Requirements"
* Quiz #8, "Adjustment of Pulsed-Arc Equipment'
* Quiz #9, "Metal Transfer in the Pulsed-Arc Spray Process"

All nine quizzes were administered to Pilot Group I. However, as previously described, Pilot Group II did not have an opportunity to take quizzes 7, 8, or 9. A summary of results for both groups is shown below:

Quizz	Group 1 Average Score	Group 2 Average Score	Group 1 Average %	Group 1 Average %
1	8.9	9.8	88.9	92.5
2	7.8	8.4	77.8	84.0
3	10.3	10.3	79.5	78.8
4	12.7	11.9	84.5	79.2
5	16.9	13.8	84.4	68.9
6	13.0	15.4	65.0	77.2
7	9.2	N/A	76.8	N/A
8	4.7	N/A	66.7	N/A
9	10.6	N/A	70.4	N/A

Based on an overall average (for quizzes 1 - 6), the two groups showed very similar performance with Pilot Group I scoring an average of 80.0 and Pilot Group II scoring an average of 80.1. Significant differences between the two groups, such as seen on quizes 5 and 6 are difficult to explain. Possible factors may include 1) different teaching techniques employed (by different instructors), 2) less time devoted to a particular topic, and 3) interest level of participants.

Trainee Attendance and Attitude

During their participation in training activities at WeldTech, trainees are provided with a weekly progress report. (See "Exhibit I - WeldTech Evaluation Form.") Feedback is provided on welding skills, which are rated from 1 (minimum skills) to 5 (excellent). An "excellent" rating indicates that the trainee has performed a variety of tasks from simple to complex with little or no instructor assistance required. Also included in this evaluation are such factors affecting productivity as "Safety Habits", "Use of Time," "Care of Equipment," "Use of Materials," "Manual Dexterity," and "Classroom Participation."

Attitude/motivation is assessed in the areas of "Industry/Energy," "Relations With Others," "Demonstrated Learning Ability," and "Dependability." These four factors are judged by the instructor to be either "Above Average," "Average," "Below Average," or "Extremely Poor." A record of attendance is also kept during the training period at WeldTech.

The trainee goes over the progress report on a weekly basis with the instructor and signs the report to indicate an understanding of the instructor's evaluation. This information on the progress report is also of interest to the employer, in this case Sterling Assembly.

Although, a complete analysis of attitude/motivational factors is beyond the scope of this report, it has been WeldTech's experience that low academic achievement and minimal skill development generally correlate with low ratings in attitude/motivation. Training can improve attitude only slightly over the course of a program as brief as that conducted for this Model Project.

Welding Skill/Qualification

Welder qualification tests were conducted during the Pilot Group I training phase. The purpose of these tests is to determine the ability of welders to deposit weld metal following a welding procedure specification and in the welding positions which will be encountered in production applications.

In Pilot group I, seven individuals were qualified in Flux-Cored Arc Welding (various positions) and five were qualified in Gas Metal Arc Welding (various positions). Due to increased in-plant training, qualification testing was not conducted with Pilot Group II due to a lack of available training time at WeldTech. (See "Exhibit J - Sample Qualification Certificate.")

Student Rating

1. As a result of this training, my welding skills have:

33% - Improved greatly
56% - Gotten slightly better
11% - Not improved at all

2. The training I received:

33% - Applies directly to my job
67% - Applies somewhat to my job
0% - Was a waste of time

3. The training consisted of:

0% - Too much theory
11% - Too many practical details
89% - About the right combination

4. The length of this training was:

11% - Too long
56% - About right
33% - Too short

5. The training material was:

0% - Very hard to understand
56% - Slightly hard to understand
44% - Easy to understand

6. The training subjects:

56% - Were very interesting
44% - Kept my interest fairly well
0% - Were boring

7. The training program seemed:

67% - Very well organized
11% - Fairly well organized
22% - Poorly organized

8. I read:

11% - All of the training materials
67% - Most of the training materials
22% - Very little of the training materials

9. The instructor was:

78% - Very knowledgable and helpful
22% - Fairly knowledgable and helpful
0% - Not very knowledgable or helpful

Student Rating Form (cont'd)

10. I feel that additional welding training:

    67% - Should be provided to all welders
    22% - Should be available to those welders who ask for it
    11% - Isn't required

11. What was of most value to you?

    Typical comments: Learning all positions of welding, practicing on different sizes of metal, flux cored techniques, performance tests.

12. What was of least value to you?

    Typical comments: Everything was valuable, didn't understand pulse arc process.

13. Please list the biggest problem you had with the training.

    Typical comments: Learning how to set the machine, the smoke, welding overhead under the table, "burnthrough" on thin metal, the sparks.

14. How could training be improved?

    Typical comments: Should be longer, more practice required for qualification/certification.

The responses seem to indicate that in general, the participants felt the training was worthwhile. Approximately 90% felt the training consisted of about the right combination of practical skills and theory and only 11% felt the length of training was too long. None said they were bored or on the other hand, that training was overly hard to understand. It was especially gratifying to note that 78% responded by indicating the instructor was very knowledgable and helpful. The main area for investigation would be that only about 1/3 of the trainees felt that pilot training "applies directly to my job."

In-Plant Follow-Up

A major part of the evaluation effort consisted of in-plant training and follow-up at Sterling Heights Assembly. The in-plant training phase consisted of coaching on the line by a WeldTech instructor to help the trainees transfer their welding fundamentals to an on-the-job situation requiring improved speed skills, a great deal of bending and stretching motion and adaptation to the moving assembly line. Pilot Group I devoted one week to this phase. Results proved so worthwhile that the duration of this phase was increased to four weeks for Pilot Group II.

When trainees returned to the plant assembly line, certain skill deficiencies not observable in the WeldTech training situation became readily apparent. In this regard, a total of four Pilot Group II trainees were moved to other jobs shortly after their return to

Sterling Heights Assembly when it became obvious they were not suited to the demands of assembly welding. Of these four, one required a medical leave, one was extremely tall (6'8") and experienced difficulty positioning himself in the moving vehicles to complete the required welds, and two others did not make satisfactory skill progress upon their return to the plant. All four were replaced by other displaced workers who received three to four weeks of in-plant training/coaching and were successful enough to obtain WeldTech certificates of completion. Conversely, a few students who had difficulty with the classroom portions at WeldTech, made a very rapid adjustment to the demands of assembly welding upon their return to Sterling Heights Assembly.

Approximately four months after training of Pilot Group II was completed, Mr. Stan Stewart, WeldTech instructor (of Pilot Group II), returned to Sterling Heights Assembly and interviewed plant supervision in the Body-In-White area to gather feedback on the training provided, make an assessment of the degree to which on-the-job welding skills have been perfected, and to solicit recommendations for improving future training. His report is as follows:

Orginal Group of Students (Pilot Group II)

1) D.D.
2) C.G.
3) R.D.
4) D.D.
5) L.S.
6) J.C.
7) J.P.
8) J.B.
9) A.R.

Replacement Students (Pilot Group II)

1) J.C.
2) T.S.
3) T.D.

D.D. - Lack of comprehension kept the trainee from achieving appreciable welding skills. Placed on a grinding job at the end of the welding line, Mr. D. is a reliable and concientous worker who can fill in on the welding line.

C.G. - At 59 years of age and questionable physical condition, Mr. G. could not stand up to the rigors of production welding. He was placed on a grinding job and is doing well.

R.D. - Mr. D. has been on medical leave since the fifth week of training.

D.D. - Mr. D. has been an exemplary employee in every way. He has had no attendance or disciplinary problems. The trainee feels his training at WeldTech was among the most rewarding experiences of his life. He has been able to keep up with production and achieves quality welds according to his supervisor. His supervisor has complete confidence and the highest regard for Mr. D.

L.S. - An outstanding student, Mr. S. has gone on to be an outstanding employee as well. He expresses sincere appreciation for his training at WeldTech and feels welding will be his lifelong trade. His supervisor has made Mr. S. his relief man, a job that requires flexibility and quick learning ability. His attendance has been good, with no warnings or write-ups, and his work ethics are excellent.

J.D. - Mr. C. has transferred to Chrysler's Outer Drive Technical Center as a welder. His supervisor says Mr. C. was the best worker on the welding line.

J.P. - Mr. P. stands 6'8" tall and had trouble getting down to the welding jobs. He was placed on a job grinding the roof of the auto and is doing a fine job.

J.B. - Mr. B. seemed to do very well on the welding job he was placed on, but his supervisor said he spent far too much time at the shop medical facility with "welders flash". For this reason, his supervisor granted him a transfer to a different department within the body shop.

A.R. - Mr. R. liked the WeldTech training very much and feels welding will be his occupation for the remainder of his career. His supervisor says he does an excellent job on the welding line but has some attendance problems. His productivity and work ethics are above average and his attitude is outstanding.

J.C. - Mr. C. has been an outstanding employee in every respect except one, attendance. His supervisor has given him one verbal warning, but no written warnings. James Mr. C. shown exceptional skill as a welder and is on the job requiring the most skill on the welding line.

T.S. - Mr. S. has been exemplary in every respect. He feels the welding training was very important for the technical knowledge he gained and looks forward to furthering his welding education. His supervisor has complete confidence in his skills and integrity.

T.D. - Mr. D. is a steady and hard worker. His supervisor says his work ethics are excellent and his attendance good. He enjoyed the welding training and would recommend WeldTech to all his friends.

At Sterling Heights, 94% of some 78,000 cars built through mid-May met Chrysler's "FTC" (first-time through capability) target, compared to the 60% - 90% of most U.S. plants using conventional technology. That is, the goal for vehicles to make it through the entire assembly process (including the welding operations) and be shipped to dealers without the necessity for of-the-line reworking is being met.

RECOMMENDATIONS

Implications for Similar Retraining Efforts

The experience gained as a result of this model project would seem to indicate that in re-training displaced workers, special attention must be devoted to a careful analysis of the following factors:

1) Job Tasks/Re-Training Needs

The actual job tasks of the trainee must be carefully analyzed to determine the most appropriate training methods to serve his/her needs. A "customized" approach should be developed to fit the particular needs of the employer and employee. An effort must be made to make the training a "real world" experience, so that learning can translate successfully to the workplace. For example, in Pilot Group I training for this project, it was found that more practice was needed in adapting to the stretching/bending and speed skills required on the moving assembly line. It was not practical to simulate this expeience at the training site. As a result, in Pilot Group II training, additional time was devoted to the on-the-job portion of training in the actual workplace.

2) Job Classifications

It must be recognized that cross-training of employees is not desirable from the employers viewpoint unless job classifications allow sufficient flexibility for the employee's skills to be utilized for increased efficiency and productivity. Therefore, the trend toward fewer distinct job classifications is one means to promote the training which is required by displaced workers. It will become necessary to analyze the extent to which this trend should be continued. Some questions to consider here are:

1) How many tasks is it feasible to expect one job classification to handle?
2) Are there incentives for the employee to improve his/her skills on-the-job?
3) Does the individual have a sufficient voice in how they are to perform the job?
4) Is there a means to move into a skilled-trades apprenticeship, based on outstanding performance?
5) Have management and labor reached an agreement on job classifications prior to planning/implementation of training?

3) Longrange Human Resource Development

In addition to training for a specific job classification, thought should be given to the long-range development of employee skills. Upgrading the workforce in this manner is beneficial to both the employer and the employee. The employer gains in terms of an increased human resource, resulting from the individual's improved technical skills and improved employee attitude of professionalism. The employee benefits by acquiring skills which are contemporary with the labor market (in the event he/she

becomes unemployed again) and has additional options to move towards higher job skill classifications with increased wages and additional security. Another benefit which shouldn't be overlooked is the reduced burden to society that results when the displaced worker is brought back into the employment mainstream.

Suggested Areas For Further Study

This model suggests several areas where further study would prove helpful, including:

1) Training for Supervisors

There is evidence to suggest that supervisors and management need some form of welding training to identify quality welds, relate to the difficulties of certain welding tasks, and reinforce the basic skills necessary to maintain quality in the work setting.

2) Trainee Attitude/Interest

Trainee attitude/interest would seem to be a critical factor in the effectiveness of retraining, perhaps even more important than mental aptitude or manual dexterity. A means to evaluate attitude/interest and address any motivational problems identified should be incorporated into a similar training program and evaluated.

3) Trainee Evaluation

A better system for evaluating individual performance in-plant should be developed. Although adequate means were available in this model project to measure the immediate effectiveness of training (via in-plant instructor evaluation), this does not guarantee longrange on-the-job performance will be satisfactorily evaluated.

4) Length of Training

There is some evidence to suggest that a self-paced training system with differing lengths of training based on individual achievement could be implemented, possibly by utilizing computer-based interactive instructional techniques.

5) Long-Range Follow-Up

This activity is needed to assess whether or not the training (and future training received) will have a long range beneficial effect on the ability of trainees to retain employment, especially if there is a downturn in the economy.

6) Large-Scale Replication

A similar project should be attempted on a larger scale, since only eighteen individuals were trained as part of the current project. Obviously, such a small group could have an influence on the universality of results obtained.

Of the six areas above, training for supervisors is judged to be most important due to their on-going function as "trainers" in the work situation. Supervisors should be well-trained in order to monitor welding quality over the long-run and take necessary corrective action.

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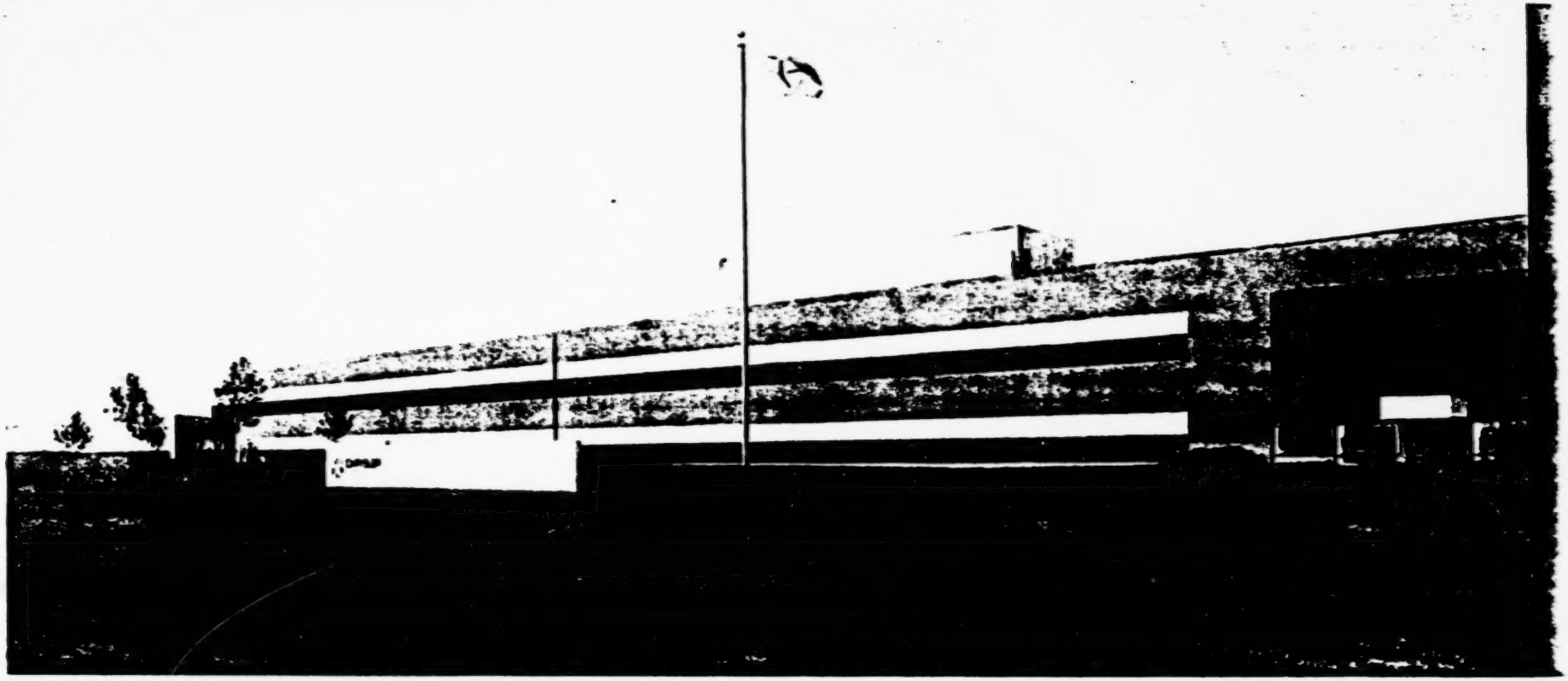
EXHIBIT A

WELCOME TO CHRYSLER CORPORATION'S

STERLING HEIGHTS ASSEMBLY PLANT



Welcome to
CHRYSLER CORPORATION'S
STERLING HEIGHTS
ASSEMBLY PLANT

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...a world-class, high-technology automotive assembly operation

CHRYSLER CORPORATION

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Thank you for your visit

...to Chrysler's Sterling Heights Assembly Plant. The diagram at the left accurately illustrates the vehicle assembly flow pattern but there is so much more to tell you.

The plant was purchased in 1983 from Volkswagen of America. The 2.75 million square foot plant occupies 301 acres and employs 2,000 hourly and salaried workers. It is the industry leader in advanced manufacturing technology with electric robots, laser scanners, immaculately clean paint shop, just-in-time inventory, in-line sequencing, performance feedback system, visual management.

The 1985 front-wheel-drive Chrysler LeBaron GTS and Dodge Lancer five-door sports sedans are built at a daily rate of 434 vehicles. These are the first Chrysler-built automobiles to benefit from a dedicated Quality Reliability facility. The 62,667 square foot building behind the main manufacturing facility will be used solely for quality and reliability evaluation of the cars and their components. Tests will be made on door systems, electrical systems, and body sealing. Components will be tested for function, reliability and specifications.

All of us at Sterling Heights Assembly are dedicated toward achieving our corporate theme... *"We Don't Want To Be The Biggest... Just The Best!"* Thank you again for being with us today.

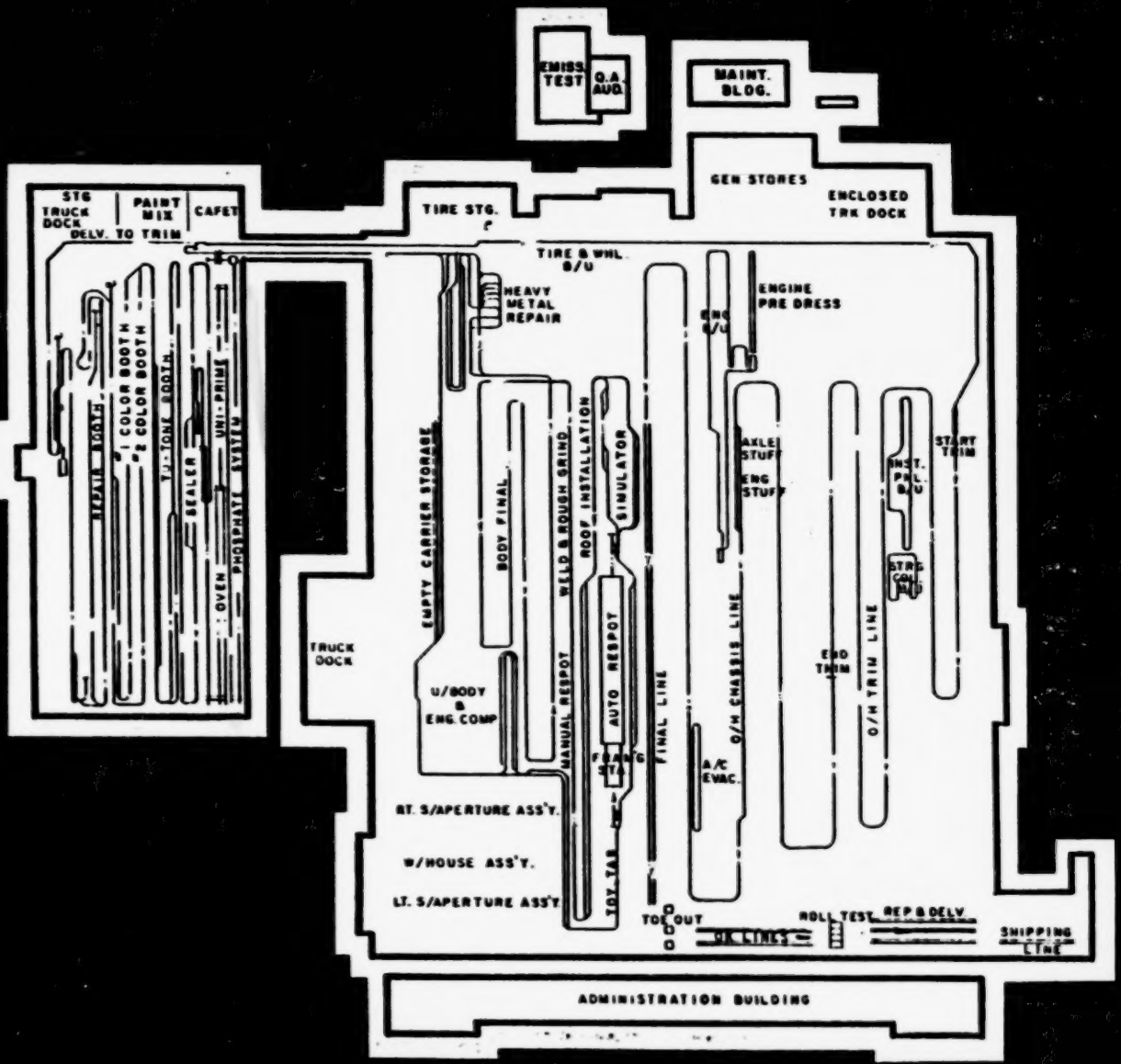
Forest J. Farmer
Plant Manager
Sterling Heights Assembly Plant

Advanced Technology... A Science-Based Activity... Let's just take a look at a few:

Innovative Operations at Sterling Heights Assembly include:

- In-Line Sequencing, in which the vehicle never loses its place in the line from the time it starts the build process to the time it emerges as a finished product.
- Visual Management, in which no racks or supplies will exceed 54 inches in height along the line. This keeps the environment open and efficient, forces constant turnover of quality parts.
- Factory Information System, which monitors all equipment.
- Just-In-Time Inventory System, with suppliers delivering on time for uninterrupted production.
- Parts Containerization, in which all parts are delivered in durable, reusable material flow-racks.
- Performance Feedback System, an on-line communication system consisting of a production data terminal at each of 1,000 stations in the plant. Employees feed data into the system, effecting immediate solutions to problems.

Robotic Training–Chrysler Sterling Heights workers receive instruction on an electric robot welder. The instruction is part of the 900,000 man-hours of training required prior to the launch of the 1985 five-door sports sedans–Chrysler LeBaron GTS and Dodge Lancer.


EMISS. TEST
Q.A. AUD.
MAINT. BLDG.
GEN STORES
ENCLOSED TRK DOCK
STG TRUCK DOCK
PAINT MIX
CAFET
DELV. TO TRIM
TIRE STG.
TIRE & WHL. B/U
HEAVY METAL REPAIR
ENGINE PRE DRESS
REPAIR BOOTH
1 COLOR BOOTH
2 COLOR BOOTH
TRI-TONE BOOTH
SEALER
OVEN
UNI-PRIME
PHOSPHATE SYSTEM
EMPTY CARRIER STORAGE
BODY FINAL
WELD & ROUGH GRIND
ROOF INSTALLATION
SIMULATOR
AXLE STUFF
ENG STUFF
INST. PNL R/F
START TRIM
STRG COL
TRUCK DOCK
U/BODY & ENG. COMP
MANUAL RESPOT
AUTO RESPOT
FOAMING STA.
FINAL LINE
A/C EVAC.
O/H CHASSIS LINE
END TRIM
O/H TRIM LINE
RT. S/APERTURE ASS'Y.
W/HOUSE ASS'Y.
LT. S/APERTURE ASS'Y
TOY. TAB
TOP OUT
ROLL TEST
REP & DELV.
SHIPPING LINE
ADMINISTRATION BUILDING

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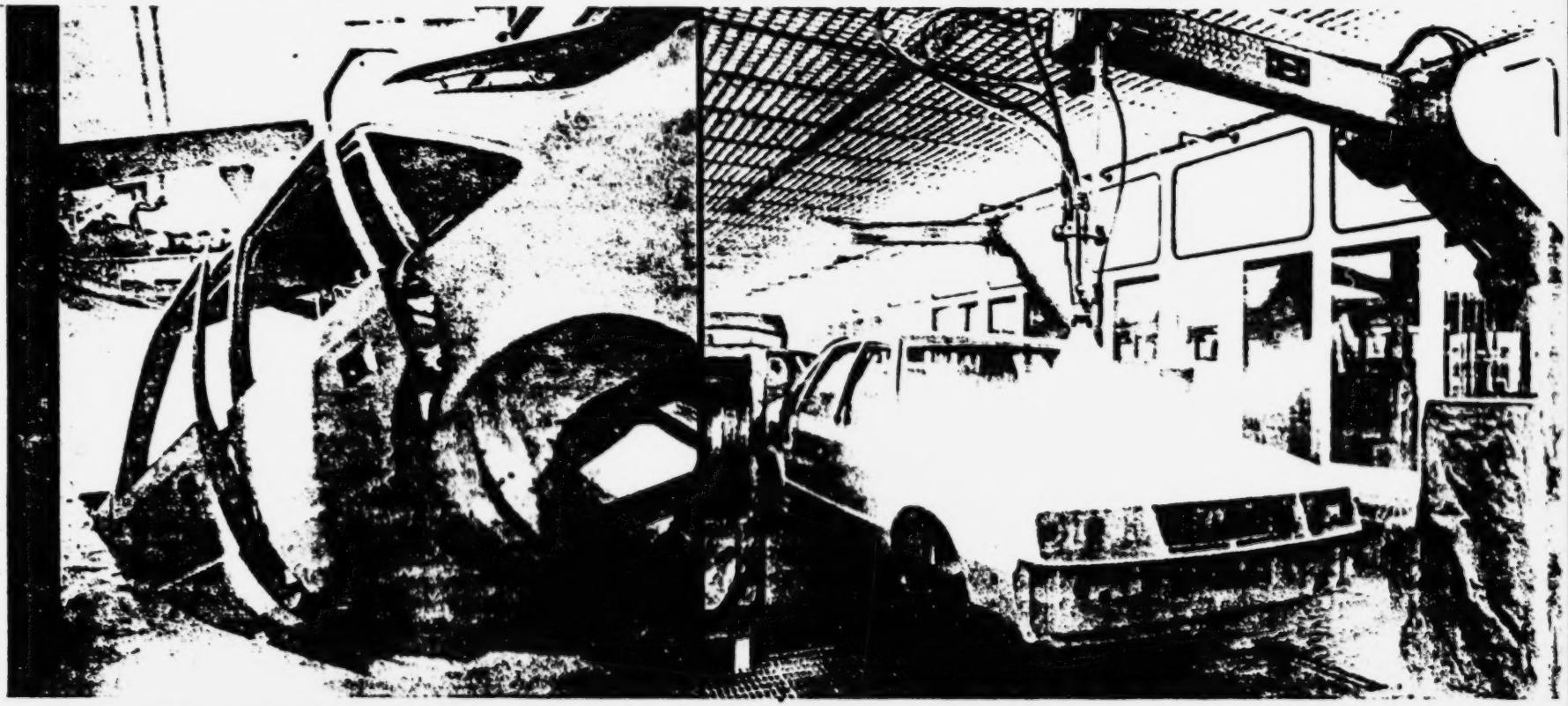
An environmentally controlled manufacturing facility primes and paints LeBaron GTS and Lancer bodies.



A unique pendulum carrier system keeps the vehicles free from drips and is easy to clean. The vehicle enters the phosphate pre-paint treatment. This includes a 10-stage system with six full immersion baths and four systems. An eight stage Uniprime system, with full immersion for three minutes and a full immersion rinse, applies a primer by the cathodic electro-deposition process.

Color is applied automatically by high-voltage electrostatic (HVES) reciprocators on the sides and top. Hand-held, state-of-the-art turbo-electrostatic guns are used for color application to the spots which cannot be reached by the reciprocators. The HVES system of spraying provides excellent distribution with high-transfer efficiency and minimal waste.

We don't want to be the biggest...just the best!

CHRYSLER CORPORATION

EXHIBIT B

1984-85 CATALOG SUPPLEMENT

FOR

WELDTECH

WELDTECH
WELDING EDUCATION CENTER

WELDTECH
WELDING EDUCATION CENTER

CHRYSLER
LEARNING INC.

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EDUCATIONAL OBJECTIVE

The objective of the training provided at the WeldTech Welding Education Center is to prepare its students for entry-level positions in the welding field, with sufficient background in theory and hands-on skill performance.

EDUCATIONAL PHILOSOPHY

The WeldTech curriculum is designed to provide training using a performance-based approach. In other words, each student is required to perform all skill tasks according to recognized industry specifications for entry-level employees in this occupational area. As a result, performance standards at WeldTech are very high.

CLASS SIZE

Classes at WeldTech Welding Education Center are typically conducted with a student to instructor ratio of 15:1 for optimum training effectiveness.

LENGTH OF TRAINING

The WeldTech Welding Education Center offers four different vocational training programs as follows:

Program	Hours/Weeks
Combination Welding	600/25
Pipe Arc Welding	600/25
Pipe MIG and TIG Welding	600/25
Maintenance Welding	840/35

Classes consist of five (5) hours of training per day, Monday through Friday, scheduled as follows:

Session	Time Schedule
1st	6:30 a.m. to 11:30 a.m.
2nd	12 noon to 5:00 p.m.
3rd	5:30 p.m. to 10:30 p.m.

QUALIFICATION/CERTIFICATION REQUIREMENTS

In order to qualify, a candidate for certification must weld test samples in accordance with specifications of the American Welding Society (AWS), or the American Society of Mechanical Engineers (ASME), or similar established codes and specifications. There is no blanket certification.

Program Descriptions

W-401 COMBINATION WELDING

Program Length: 60 hours/25 weeks

Objective: To develop skills in the major hand-held welding processes: Oxyacetylene Welding & Cutting (OAW) Shielded Metal Arc Welding (SMAW), Gas Metal Arc Welding (GMAW), Flux Cored Arc Welding (FCAW), and Gas Tungsten Arc Welding (GTAW). The student will also learn to read blueprints and apply this knowledge to layout and fabrication of metal products under simulated work conditions.

Application: This sequence of classes is designed to provide the student with the basic skills necessary for employment as entry-level Combination Welder.

Required Classes:

Program No. and Title	Hours/Weeks
W-101 Oxyacetylene	120/5
W-102 Basic Shielded Metal Arc	120/5
W-106 Gas Metal Arc and Flux Cored	120/5
W-108 Gas Tungsten Arc	120/5
W-110 Fabrication and Blueprint Reading for Welders & Fitters	120/5

W-402 PIPE ARC WELDING

Program Length: 60 Hours/25 Weeks

Objective: To develop the skills necessary to produce high quality welds on carbon steel pipe in all positions.

Application: This sequence of classes is designed to prepare the student for entry-level employment in the major pipe welding areas using this process i.e. pipe line construction, pressure and nuclear piping.

Required Classes:

Program No. and Title	Hours/Weeks
W-101 Oxyacetylene	120/5
W-102 Basic Shielded Metal Arc	120/5
W-103 Advanced Shielded Metal Arc	120/5
W-104 Pipe Shielded Metal Arc-Uphill	120/5
W-105 Pipe Shielded Metal Arc-Downhill	120/5

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W-403 PIPE MIG AND TIG WELDING

Program Length: 600 Hours/25 Weeks

Objective: To develop the skills required to produce high quality groove & fillet welds on carbon steel and stainless steel pipe and tubing in all positions.

Application: On completion of the program, the student will be prepared for entry level employment in the major pipe welding areas using MIG & TIG Welding process. i.e. pressure and nuclear piping fields.

Required Classes:

Program No. and Title	Hours/Weeks
W-101 Oxyacetylene	120/5
W-106 Gas Metal Arc	120/5
W-107 Pipe-Gas Metal Arc	120/5
W-108 Gas Tungsten Arc	120/5
W-109 Pipe-Gas Tungsten Arc	120/5

W-404 MAINTENANCE WELDING COURSE

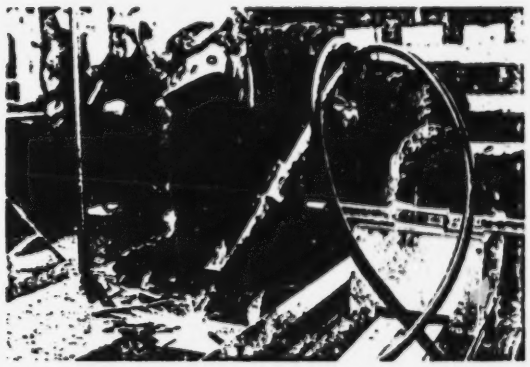
Course Length: 840 Hours/35 Weeks

Objective: To develop the skills necessary to repair broken or cracked cast iron and aluminum parts, fill holes and resurface worn metal parts.

Application: This is a broad based course, which provides training, basic and advanced, in all of the major hand-held welding processes, together with instruction in Blueprint Reading and practical application of these skills.

Required Classes:

Program No. and Title	Hours/Weeks
W-101 Oxyacetylene	120/5
W-102 Basic Shielded Metal Arc	120/5
W-103 Advanced Shielded Metal Arc	120/5
W-106 Gas Metal Arc Welding	120/5
W-108 Gas Tungsten Arc Welding	120/5
W-110 Fabrication and Blueprint Reading for Welders & Fitters	120/5
W-111 Applied Maintenance Welding	120/5



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PROGRAM* TUITION AND FEES

Program No. and Title	Required Classes	Total Hours	Tuition
W-401 Combination Welding Program	W-101 W-102 W-106 W-108 W-110	600	$3,600.00
W-402 Pipe "Arc" Welding Program	W-101 W-102 W-103 W-104 W-105	600	$3,600.00
W-403 Pipe MIG & TIG Welding Program	W-101 W-106 W-107 W-108 W-109	600	$3,600.00
W-404 Maintenance Welding Program	W-101 W-102 W-103 W-106 W-108 W-110 W-111	840	$5,124.00

INDIVIDUAL CLASSES*

Class No. and Title	Total Hours	Tuition
W-101 OAW	120	$730.00
W-102 Basic SMAW	120	840.00
W-103 Advanced SMAW	120	900.00
W-104 Pipe SMAW-Uphill	120	960.00
W-105 Pipe SMAW-Downhill	120	960.00
W-106 GMAW	120	900.00
W-107 Pipe GMAW	120	900.00
W-108 GTAW	120	840.00
W-109 Pipe GTAW	120	900.00
W-110 Fabrication and Blueprint Reading	120	900.00
W-111 Applied Maint. Weld.	120	900.00
W-112 Basic Weld. Sculpture	96	400.00

*Note: Cost of tools required for all students is an additional $390.00

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SCHOOL CALENDAR

Program Starts (Effective May 1, 1984)

First Session	Second Session	Third Session
May 28	May 28	May 14
July 2May 28	July 2	June 18
August 6	August 6	July 23
September 10	September 10	August 27
October 15	October 15	October 1
November 19	November 19	November 5
		December 10

SCHOOL GOVERNING BODY

The WeldTech Education Center was established as a private tuition school in 1978 by Chrysler Learning, Inc., a training subsidiary of Chrysler Corporation, in response to the need for qualified people in the welding occupational area. The officers and directors of Chrysler Learning, Inc. function as the governing body for The WeldTech Welding Education Center.

School Officials

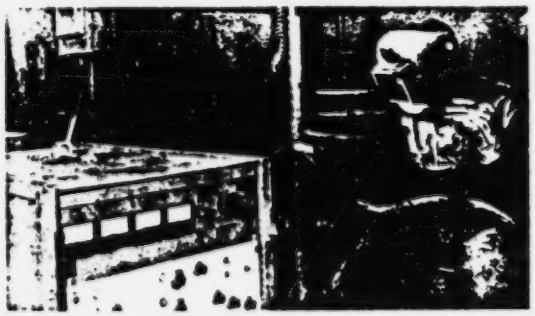
Name	Title
Glen A. Knight	Director of WeldTech
Dennis Arnold	Manager of Admissions
Alberta L. Muzzin	Financial Aid Administration
Byron Swarts	Placement Officer

Instructional Staff

Lawrence Bigelow	Shift Supervisor
Ralph Rodriquez	Shift Supervisor
George Blair	
Brian Brunn	
Michael Cain	
Patrick Clayton	
Dave Herron	
Karl Lis	
Gerald Ross	
Lawrence Smith	
Thomas Soley	

Support Staff

Richard Camburn	Admissions Representative
James Higgins	Admissions Representative
Harvey Kurley	Admissions Representative
Patrick Mann	Admissions Representative
Toyia Martin	Financial Aid Clerk
Roxanne Staten	Cashier



SCHOOL FACILITIES

The WeldTech Welding Education Center is located at 20201 Hoover Road, in Detroit, Michigan, near Eight Mile Road. Please refer to the Detroit/Metro map on this page for directions to the school.

The school building consists of 13,000 square feet, including space designated for classrooms, hands-on training labs, offices, an eating area and restrooms. WeldTech is equipped with up-to-date equipment as is used in welding for modern industry.

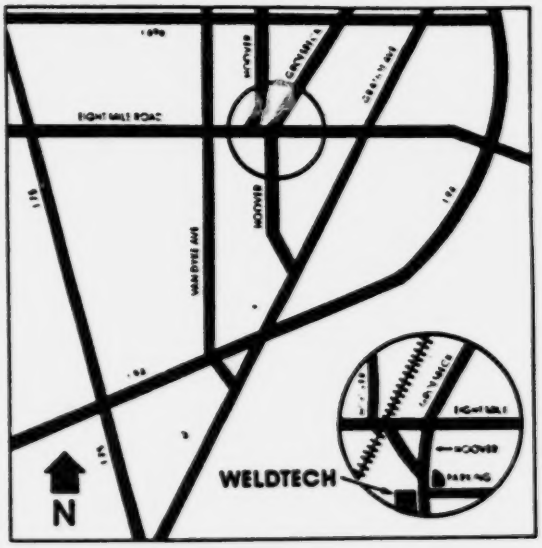


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EXHIBIT C

WELDING DUTIES/TASKS

OF

QUALITY OPERATORS

WELDING DUTIES/TASKS OF S.H.A.P. QUALITY OPERATORS

AND PRELIMINARY WELDTECH TRAINING PLAN

(PREPARED FOR 5/10/84 ADVISORY COMMITTEE MEETING)

JOB DUTY/TRAINING UNIT	LESSON #	JOB TASK/TRAINING ACTIVITY: EXERCISE	JOINT	POSITION	LECTURE	LAB	S.H.A.P. APPLICATION/ TRAINING RATIONALE	EVALUATION PROCEDURE/CRITERIA
GAS METAL ARC WELDING— APPROXIMATELY 110 TRAINING HOURS								
Perform Gas Metal Arc Welding on uncoated sheet metal as preparation for Flux-Cored Arc Welding, including Fillet Welds on lap and tee joints in all positions.	A-1	Introduction to GMAW Process			x		Provide training with basic orientation to Gas Metal Arc Welding Process and techniques	70% score on written quiz
	A-2	Safety & Health of Welders			x			
	A-3	Adjustment of Equipment			x			
	A-4	Power Sources			x			
	A-5	Quality Butt & Fillet Welds			x			
	A-6	Welding Distortion Control			x			
	A-7	Metal Transfer & Shielding Gas			x			
	A-8	Pad of Beads 1/8" mild steel .035 dia. wire	PAD	FLAT		x	Familiarize trainee with machine adjustments and gun manipulations	Visual weld inspection to AWS specifications

WELDING DUTIES/TASKS OF S.H.A.P. QUALITY OPERATORS

AND PRELIMINARY WELDTECH TRAINING PLAN

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JOB DUTY/TRAINING UNIT	LESSON #	JOB TASK/TRAINING ACTIVITY			LECTURE	LAB	S.H.A.P. APPLICATION/ TRAINING RATIONALE	EVALUATION PROCEDURE/CRITERIA
		EXERCISE	JOINT	POSITION				
GAS METAL ARC WELDING— CONT'D	A-9	Fillet Weld 1/8" mild steel .035 dia. wire	LAP	FLAT		x	Trainee acquires skills to provide quality Fillet Welds on lap joints in all positions. Trainee will learn basic welding techniques on solid wire initially to gian experience in producing quality welds without the distractions caused by the smoke and molten slag present in the Flux-Cored process.	Visual weld inspection to AWS specifications
	A-10	Fillet Weld 1/8" mild steel .035 dia. wire	LAP	HORZ		x		
	A-11	Fillet Weld 1/8" mild steel .035 dia. wire	LAP	VERT/DOWN		x		
	A-12	Fillet Weld 1/8" mild steel .035 dia. wire	LAP	VERT/UP		x		
	A-13	Fillet Weld 1/8" mild steel .035 dia. wire	LAP	OVERHEAD		x		

WELDING DUTIES/TASKS OF S.H.A.P. QUALITY OPERATORS

AND PRELIMINARY WELDTECH TRAINING PLAN

(PREPARED FOR 5/10/84 ADVISORY COMMITTEE MEETING)

JOB DUTY/TRAINING UNIT	LESSON #	JOB TASK/TRAINING ACTIVITY			THEORY	LAB	S.H.A.P. APPLICATION/ TRAINING RATIONALE	EVALUATION PROCEDURE/CRITERIA
		EXERCISE	JOINT	POSITION				
GAS METAL ARC WELDING CONT'D	A-14	Fillet Weld 1/8" mild steel .035 dia. wire	TEE	FLAT		x	Trainee acquires skills to produce quality Fillet Welds on tee joints in all positions. Tee joints are utilized to help trainee identify common weld defects such as burn-through and suckback.	Visual weld inspection to AWS specifications
	A-15	Fillet Weld 1/8" mild steel .035 dia. wire	TEE	HORZ		x		
	A-16	Fillet Weld 1/8" mild steel .035 dia. wire	TEE	VERT/DOWN		x		
	A-17	Fillet Weld 1/8" mild steel .035 dia. wire	TEE	VERT/UP		x		
	A-18	Fillet Weld 1/8" mild steel .035 dia. wire	TEE	OVERHEAD		x		
	A-19	Fillet Weld 1/16" mild steel .035 dia. wire	LAP	HORZ		x	Trainee will refine welding skills on thinner sheet metal such as used in production welds.	Same as above
	A-20	Fillet Weld 1/16" mild steel .035 dia. wire	LAP	VERT/DOWN		x		
	A-21	Fillet Weld 3/32" mild steel .035 dia. wire	LAP	HORZ		x		
	A-22	Fillet Weld 3/32" mild steel .035 dia. wire	LAP	VERT/DOWN		x		
	A-23	Fillet Weld 3/64" mild steel .035 dia. wire	LAP	HORZ		x		
	A-24	Fillet Weld 3/64" mild steel .035 dia. wire	LAP	VERT/DOWN		x		
	A-25	Fillet Weld .035 mild steel .035 dia. wire	LAP	HORZ		x		

WELDING DUTIES/TASKS OF S.H.A.P. QUALITY OPERATORS

AND PRELIMINARY WELDTECH TRAINING PLAN

(PREPARED FOR 5/10/84 ADVISORY COMMITTEE MEETING)

JOB DUTY/TRAINING UNIT	LESSON #	JOB TASK/TRAINING ACTIVITY			INSTRUCTION	LAB	S.H.A.P. APPLICATION/ TRAINING RATIONALE	EVALUATION PROCEDURE/CRITERIA
		EXERCISE	JOINT	POSITION				
FLUX-CORED ARC WELDING— APPROXIMATELY 80 TRAINING HOURS								
	B-1	Introduce to Flux-Cored Arc Welding			x		Provide trainee with	70% score on
	B-2	Safety & Health of Welders			x		orientation to Flux-	written quiz
	B-3	Power Sources			x		Cored Arc Welding	
Perform Flux-Cored Arc Welding on coated (galvanized) and uncoated sheet metal, including Fillet Welds on lap and tee joints in all positions.	B-4	Adjustment of Equipment			x		process as used at	
	B-5	Quality Fillet Welds			x		S.H.A.P.	
	B-6	Fillet Weld 1/16 galvanized steel .062 - E71T-GS	LAP	HORZ		x	Trainee will develop skills to produce and	Visual weld inspection to AWS
	B-7	Fillet Weld 1/16 galvanized steel .062 - E71T-GS	LAP	VERT		x	recognize quality welds beads on sheet metal mild steel through proper machine adjustment, electrode wire stickout and welding techniques.	specifications

WELDING DUTIES/TASKS OF S.H.A.P. QUALITY OPERATORS

AND PRELIMINARY WELDTECH TRAINING PLAN

(PREPARED FOR 5/10/84 ADVISORY COMMITTEE MEETING)

JOB DUTY/TRAINING UNIT	LESSON #	JOB TASK/TRAINING ACTIVITY			LECTURE	LAB	S.H.A.P. APPLICATION/ TRAINING RATIONALE	EVALUATION PROCEDURE/CRITERIA
		EXERCISE	JOINT	POSITION				
54 FLUX-CORED ARC WELDING CONT'D	B-8	Fillet Weld 1/16 galvanized steel .062 - E71T-GS	TEE	HORZ		x	Tee joints are utilized to help trainee identify and avoid common weld defects, such as burn-through and suckback.	Visual weld inspection to AWS specifications
	B-9	Fillet Weld 1/16 galvanized steel .062 - E71T-GS	TEE	VERT		x		
	B-10	Fillet Weld 1/16 to 1/8 galvanized steel .062 - E71T-GS	LAP	HORZ		x	Exercises used to simulate typical welds used in Chrysler Plants (e.g. engine and suspension mounting brackets welded to unibody assembly)	Visual weld inspection to AWS specifications
	B-11	Fillet Weld 1/16 to 1/8 galvanized steel .062 - E71T-GS	LAP	VERT		x		

WELDING DUTIES/TASKS OF S.H.A.P. QUALITY OPERATORS

AND PRELIMINARY WELDTECH TRAINING PLAN

(PREPARED FOR 5/10/84 ADVISORY COMMITTEE MEETING)

JOB DUTY/TRAINING UNIT	LESSON #	JOB TASK/TRAINING ACTIVITY			LECTURE	LAB	S.H.A.P. APPLICATION/ TRAINING RATIONALE	EVALUATION PROCEDURE/CRITERIA
		EXERCISE	JOINT	POSITION				
FLUX-CORED ARC WELDING CONT'D	B-12	Fillet Weld 1/16 galvanized to 1/4 mild steel .062 - E71T-GS	LAP	HORZ		x	Exercised used to simulate door hinge assembly welds in Zone 7.	Visual weld inspection to AWS specifications.
	B-13	Fillet Weld 1/16 galvanized to 1/4 mild steel .062 - E71T-GS	LAP	VERT		x		
	B-14	Fillet Weld 1/8 galvanized to 1/4 mild steel .062 - E71T-GS	LAP	HORZ		x		
	B-15	Fillet Weld 1/8 galvanized to 1/4 mild steel .062 - E71T-GS	LAP	VERT		x		

WELDING DUTIES/TASKS OF S.H.A.P. QUALITY OPERATORS

AND PRELIMINARY WELDTECH TRAINING PLAN

(PREPARED FOR 5/10/84 ADVISORY COMMITTEE MEETING)

JOB DUTY/TRAINING UNIT	LESSON #	JOB TASK/TRAINING ACTIVITY			LECTURE	LAB	S.H.A.P. APPLICATION/ TRAINING RATIONALE	EVALUATION PROCEDURE/CRITERIA
		EXERCISE	JOINT	POSITION				
GAS METAL ARC-PULSE BRAZING--APPROXIMATELY 80 TRAINING HOURS	C-1	Introduction to Pulse Arc MIG Brazing			x		Provide trianee with orientation to Pulsed Arc MIG Brazing process and techniques	70% score on written quiz
	C-2	Safety & Health of Welders			x			
	C-3	Adjustment of Equipment & Power Sources			x			
	C-4	Quality of Welds			x			
Perform Gas Metal Arc-Pulse (or MIG Braze) welding on coated (galvanized sheet metal, including Fillet Welds on lap joints in all positions	C-5	Fillet Weld .035 Dia. Sil Bronze .059 galvanized steel	LAP	HORZ		x	Trainee will develop skill to produce and recognize quality brazed joints on galvanized sheet metal through proper machine adjustment of pulsed-arc power source, electrode wire sitckout, and welding techniques, using gas-shielded silicon-bronze electrode wire.	Visual weld inspection to AWS specifications
	C-6	Fillet Weld .035 Dia. Sil Bronze .059 galvanized steel	LAP	VERT		x		
	C-7	Fillet Weld .035 Dia. Sil Bronze .059 gal-	LAP	OVERHEAD		x		

WELDING DUTIES/TASKS OF S.H.A.P. QUALITY OPERATORS

AND PRELIMINARY WELDTECH TRAINING PLAN

(PREPARED FOR 5/10/84 ADVISORY COMMITTEE MEETING)

JOB DUTY/TRAINING UNIT	LESSON #	JOB TASK/TRAINING ACTIVITY			LECTURE	LAB	S.H.A.P. APPLICATION/ TRAINING RATIONALE	EVALUATION PROCEDURE/CRITERIA
		EXERCISE	JOINT	POSITION				
GAS METAL ARC-PULSE BRAZING (CONT'D)							Exercises used to simulate welds on various places on unibody assembly. (E.G., Stations 4 and 6)	
	C-8	Fillet Weld .035 Dia. Sil Bronze .034 galvanized steel	LAP	HORZ		x	(E.G., Stations 1,2, 5,6,7, and 9)	Visual weld inspection to AWS specifications
	C-9	Fillet Weld .035 Dia. Sil Bronze .034 galvanized steel	LAP	VERT		x		
	C-10	Fillet Weld .035 Dia. Sil Bronze .034 galvanized steel	LAP	OVERHEAD		x		
	C-11	Fillet Weld .059 galvanized steel to .034 galvanized steel	LAP	HORZ/VERT		x	(E.G., Stations 1,2, and 3)	Same as above
	C-12	Fillet Weld .059 galvanized steel to .034 galvanized steel	LAP	HORZ/VERT		x		

WELDING DUTIES/TASKS OF S.H.A.P. QUALITY OPERATORS

AND PRELIMINARY WELDTECH TRAINING PLAN

(PREPARED FOR 5/10/84 ADVISORY COMMITTEE MEETING)

JOB DUTY/TRAINING UNIT	LESSON #	JOB TASK/TRAINING ACTIVITY			LECTURE	LAB	S.H.A.P. APPLICATION/ TRAINING RATIONALE	EVALUATION PROCEDURE/CRITERIA
		EXERCISE	JOINT	POSITION				
58 GAS METAL ARC-PULSE BRAZING (CONT'D)	C-13	Fillet Weld .035 Dia. Sil Bronze .028 galvanized steel	LAP	HORZ		x	(E.G., Stations 2,5,6 7, and 9)	Visual weld inspection to AWS specifications.
	C-14	Fillet Weld .035 Dia. Sil Bronze .028 galvanized steel	LAP	VERT		x		
	C-15	Fillet Weld .035 Dia. Sil Bronze .028 galvanized steel	LAP	OVERHEAD		x		
	C-16	Fillet Weld .035 Dia. Sil Bronze, spot weld .059 galvanized steel	LAP	HORZ		x	Exercises used to achieve specific weld lengths for various production stations at S.H.A.P.	Same as above
	C-17	Fillet Weld .035 Dia. Sil Bronze, spot weld .059 galvanized steel	LAP	VERT		x		
	C-18	Fillet Weld .035 Dia. Sil Bronze, spot weld .059 galvanized steel	LAP	OVERHEAD		x		
	C-19	Fillet Weld .035 Dia. Sil Bronze, spot weld .034 & .028 galvanized steel	LAP	HORZ		x		
	C-20	Fillet Weld .035 Dia. Sil Bronze, spot weld .034 & .028 galvanized steel	LAP	VERT		x		
	C-21	Fillet Weld .035 Dia. Sil Bronze, spot weld .034 & .028 galvanized steel	LAP	OVERHEAD		x		

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EXHIBIT D

MODEL PROJECT PERFORMANCE OBJECTIVES

WELDING SKILLS TRAINING FOR QUALITY OPERATORS

TERMINAL PERFORMANCE OBJECTIVES

OBJ. #	CONDITIONS	PERFORMANCE	CRITERIA
1	Given the names of various welding processes	Identify the two welding processes used by Quality Operators	With 100% accuracy
2	Given a series of definition statements	Identify the correct definitions of the terms "flux-cored arc welding" and "pulsed-arc MIG brazing"	With 100% accuracy
3	Given descriptions of various welding tasks	Indicate which of the welding processes used by Quality Operators would be most appropriate to perform a specific welding task	With 70% accuracy
4	Given a list of welding terms and a series of definition statements	Match basic welding terms to their correct definitions, including: - shielding gas - spatter - metal transfer - joint - fillet weld - fusion - distortion.	With 70% accuracy.
5	Given appropriate illustrations	Identify the four positions for fillet welds	With 100% accuracy
6	Given appropriate illustrations	Identify lap and tee joints	With 100% accuracy

WELDING SKILLS TRAINING FOR QUALITY OPERATORS

TERMINAL PERFORMANCE OBJECTIVES

OBJ. #	CONDITIONS	PERFORMANCE	CRITERIA
7	Given appropirate illustrations	Identify by name welding equipment items used by Quality Operators	With 100% accuracy
8	Given a list of welding equipment	Match names of welding equipment items to a description of their usage or most outstanding feature	With 100% accuracy
9	Given several possible alternatives	Select the most appropriate technique for adjustment and/or manipulation of welding equipment in a given situation	With 70% accuracy
10	Given the necessary equipment and materials	Demonstrate the proper adjustment and manipulation of basic welding equipment by making a pad of bead welds along the length of a 1/8" mild steel plate in the flat position using .035 diameter electrode wire	To instructor's satisfaction

WELDING SKILLS TRAINING FOR QUALITY OPERATORS

TERMINAL PERFORMANCE OBJECTIVES

OBJ. #	CONDITIONS	PERFORMANCE	CRITERIA
11	Given a list of welding safety equipment	Identify the specific items that should be used by Quality Operators	With 100% accuracy
12	Given a series of welding safety procedures for Quality Operators	Identify the welding hazards which a particular safety procedure is designed to protect against	With 70% accuracy
13	Given various possible choices	Identify five AWS standards used for the visual inspection of welds	With 100% accuracy
14	Given a series of definition statements	Identify the correct definitions of the terms "burnthrough" and "suckback"	With 100% accuracy
15	Given appropriate illustrations	Differentiate a quality fillet weld from samples of weld defects	With 100% accuracy
16	Given the necessary equipment	Use gas metal arc welding process to fillet weld mild steel to make lap joints in all positions on 1/8", 1/16", 3/32", 3/64" and .035" thick stock using .035" diameter electrode wire	To AWS specifications

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WELDING SKILLS TRAINING FOR QUALITY OPERATORS

TERMINAL PERFORMANCE OBJECTIVES

OBJ. #	CONDITIONS	PERFORMANCE	CRITERIA
17	Given the necessary equipment and materials	Use gas metal arc welding process to fillet weld mild steel to make tee joints in all positions on 1/8" thick stock using .035" diameter electrode wire	To AWS specifications
18	Given the necessary equipment and materials	Use flux-cored arc welding process to fillet weld sheet metal to make lap joints in all positions with .062" diameter electrode wire on - 1/16" galvanized steel - 1/16" to 1/8" galvanized steel - 1/16" galvanized to 1/4" mild steel - 1/8" galvanized to 1/4" mild steel	To AWS specifications
19	Given the necessary equipment	Use flux-cored arc welding process to fillet weld sheet metal to make tee joints in all positions with .062" diameter electrode wire on 1/16" galvanized steel	To AWS specifications

WELDING SKILLS TRAINING FOR QUALITY OPERATORS

TERMINAL PERFORMANCE OBJECTIVES

OBJ. #	CONDITIONS	PERFORMANCE	CRITERIA
20	Given the necessary equipment and materials	Use pulsed-arc MIG brazing process to fillet weld coated sheet metal to make lap joints in all positions with .035" diameter Sil Bronze electrode wire on: - .059" galvanized steel - .034" galvanized steel - .059" to .034" galvanized steel - .028" galvanized steel	To AWS specifications
21	Given the necessary equipment and materials	Use pulsed-arc MIG brazing process to fillet spot weld coated sheet metal to make lap joints in all positions with .035" diameter Sil Bronze electrode wire on: - .059" galvanized steel - .034" galvanized steel - .028" galvanized steel	To AWS specifications
22	Given several possible choices	Identify the most common malfunctions on welding equipment used by Quality Operators	With 70% accuracy
23	Given a series of common welding equipment malfunctions	Identify the recommended preventive maintenance procedures to be used with each item of equipment	With 70% accuracy

WELDING SKILLS TRAINING FOR QUALITY OPERATORS

TERMINAL PERFORMANCE OBJECTIVES

OBJ. #	CONDITIONS	PERFORMANCE	CRITERIA
24	Given proper equipment and materials	Replace the nozzle of a welding gun	In seconds
25	Given proper equipment and materials	Dress and change welding gun tips	In seconds
26	Given necessary equipment and materials	Demonstrate increasing speed skills in simulating all required flux-cored arc welds used by Quality Operators at S.H.A.P. weldbooth stations #1 - #15	To AWS specifications
27	Given necessary equipment and materials	Demonstrate increasing speed skills in simulating all required pulsed-arc MIG brazing welds used by Quality Operators at S.H.A.P. weldbooth stations #1 - #15	To AWS specifications
28	Given necessary equipment and materials	Perform quality fillet welds on the moving assembly line as required at S.H.A.P. weldbooth stations #1 - #15	To AWS specifications

WELDING SKILLS TRAINING FOR QUALITY OPERATORS

TERMINAL PERFORMANCE OBJECTIVES

OBJ. #	CONDITIONS	PERFORMANCE	CRITERIA
29	Given necessary equipment and materials	Perform minor maintenance tasks to welding equipment on the moving assembly line per S.H.A.P. time limitations	To AWS specifications

EXHIBIT E

WELDTECH SKILL FORMS

WELDTECH Skill Achievement Form

udent's Name _____ Soc.Sec.No. _____

Class Sterling Hgts. Assembly Plant

sson lo.	Joint	Posit-ion	Exercise	Start Date	Complet-ion Date	Performance Level *
1			Introduction to GMAW Lecture			
2			Safety & Health of Welders Lecture			
3			Adjustment of Equipment Lecture			
4			Power Source Lecture			
5			Quality butt & Fillet Welds. Lecture			
6			Welding Distrotion control Lecture			
7			Metal Transfer & Shielding Gas Lecture			
8	PAD	FLAT	Pad of Beads 1/8" mild steel 045 Dia. wire			
9	LAP	FLAT	Fillet Weld 1/8" mild steel .045 Dia. wire			
10	LAP	HORZ	Fillet Weld 1/8" mild steel .045 Dia. wire			
11	LAP	VERT DOWN	Fillet Weld 1/8" mild steel .045 Dia. wire			
12	LAP	OVER HEAD	Fillet Weld 1/8" mild steel .045 Dia. wire			
13	TEE	FLAT	Fillet Weld 1/8" mild steel .035 Dia. wire			
14	TEE	HORZ	Fillet Weld 1/8" mild steel .035 Dia. wire			
15	TEE	VERT DOWN	Fillet Weld 1/8" mild steel .035 Dia. wire			
16	TEE	OVER HEAD	Fillet Weld 1/8" mild steel .035 Dia. wire			
17	LAP	HORZ	Fillet Weld 1/16" mild steel .035 Dia. wire			
18	LAP	VERT DOWN	Fillet Weld 1/16" mild steel .035 Dia. wire			
19	LAP	HORZ	Fillet Weld 3/32" mild steel .035 Dia. wire			
20	LAP	VERT DOWN	Fillet Weld 3/32" mild steel .035 Dia. wire			
21	LAP	HORZ	Fillet Weld 3/64 " mild steel .035 Dia. wire			
22	LAP	VERT DOWN	Fillet Weld 3/63" mild steel .035 Dia. wire			
23	LAP	HORZ	Fillet Weld .035 mild steel .035 Dia. wire			

* Notes that the student did not complete this lesson.

WELDTECH Skill Achievement Form

tudent's Name _____ Soc.Sec.No. _____

Class Sterling Hgts. Assembly Plant

esson lo.	Joint	Posit-ion	Exercise	Start Date	Complet-ion Date	Performance Level
1			Introduction to Flux Cored Process (Lecture)			
2	LAP	2F	Fillet Weld 5/64" Dia. E70T-1 Spray Trans. Mild Steel 3/8 x 2 x 12			
3	TEE	2F	Fillet Weld 5/64" Dia. E70T-1 Spray Trans. Mild Steel 3/8 x 2 x 12			
4	LAP	2F	Fillet Weld 3/32" Dia. E70T-4 Globular Trans. Mild Steel 3/8 x 2 x 12			
5	TEE	2F	Fillet Weld 3/32 Dia. E70T-4 Globular Trans. Mild Steel 3/8 x 2 x 12			
6	LAP	2F	Fillet Weld .062 E71T-GS 1/16 Galvanized Steel			
7	TEE	2F	Fillet Weld .062 Dia. E71T-GS 1/16 Galvanized Steel			
8	LAP	3F	Fillet Weld .062 Dia. E71T-GS 1/16 Galvanized Steel			
9	TEE	3F	Fillet Weld .062 Dia. E71T-GS 1/16 Galvanized Steel			
10	LAP	2F	Fillet Weld .062 Dia. E71T-GS 1/16 Galvanized Steel			
11	LAP	3F	Fillet Weld .062 Dia. E71T-GS 1/16 to 1/8 Galvanized Steel			
12	LAP	2F	Fillet Weld .062 Dia. E71T-GS 1/16 Galvanized to 1/4 mile Steel			
13	LAP	3F	Fillet Weld .062 Dia. E71T-GS 1/16 Galvanized to 1/4 Mild Steel			
14	LAP	2F	Fillet Weld .062 Dia. E71T-GS 1/8 Galvanized to 1/4 mile Steel			
15	LAP	3F	Fillet Weld .062 Dia. E71T-GS 1/8 Galvanized to 1/4 mild Steel			
16	LAP	2F	Fillet Weld .062 Dia. E71T-GS 1/16 Mile Steel			
17	LAP	3F	Fillet Weld .062 Dia. E71T-GS 1/16 mild Steel			
18	LAP	2F	Fillet Weld .062 Dia. E71T-GS 1/16 to 1/8 mild steel			
19	LAP	3F	Fillet Weld .062 Dia. E71T-GS 1/16 to 1/8 mild steel			
20	LAP	2F	Fillet Weld .062 Dia. E71T-GS 1/8 to 1/4 mild steel			
21	LAP	3F	Fillet Weld .062 Dia. E71T-GS 1/8 to 1/4 mild steel			
22	LAP	2F	Fillet Weld .062 Dia. E71T-GS 1/16 to 1/4 mild steel			
23	LAP	3F	Fillet Weld .062 Dia. E71T-GS 1/16 to 1/4 mild steel			

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WELDTECH Skill Achievement Form

Student's Name _____ Soc.Sec.No. _____

Class STERLING HEIGHTS ASSEMBLY PLANT

Lesson No.	Joint	Position	Exercise	Start Date	Completion Date	Performance Level
1			Introduction to Pulse Arc MIG Brazing (Lecture)			
2			Safety & Health of Welders (Lecture)			
3			Adjustment of Equipment & Power Sources			
4			Quality of Welds (Lecture)			
5	LAP	HORZ	Fillet Weld .035 Dia. Sil Bronze .059 galvanized steel			
6	LAP	VERT	Fillet Weld .035 Dia. Sil Bronze .059 galvanized steel			
7	LAP	OVER HEAD	Fillet Weld .035 Dia. Sil Bronze .059 galvanized steel			
8	LAP	HORZ	Fillet Weld .035 Dia. Sil Bronze .034 galvanized steel			
9	LAP	VERT	Fillet Weld .035 Dia. Sil Bronze .034 galvanized steel			
10	LAP	OVER-HEAD	Fillet Weld .035 Dia. Sil Bronze .034 galvanized steel			
11	LAP	HORZ/ VERT	Fillet Weld .059 galvanized steel to .034 galvanized steel			
12	LAP	HORZ/ VERT	Fillet Weld .059 galvanized steel to .034 galvanized steel			
13	LAP	HORZ	Fillet Weld .035 Dia. Sil Bronze .028 galvanized steel			
14	LAP	VERT	Fillet Weld .035 Dia. Sil Bronze .028 galvanized steel			
15	LAP	OVER-HEAD	Fillet Weld .035 Dia. Sil Bronze .028 galvanized steel			
16	LAP	HORZ	Fillet Weld .035 Dia. Sil Bronze, spot weld .059 galvanized steel			
17	LAP	VERT	Fillet Weld .035 Dia. Sil Bronze, spot weld .059 galvanized steel			
18	LAP	OVER-HEAD	Fillet Weld .035 Dia. Sil Bronze, spot weld .059 glavanized steel			
19	LAP	HORZ	Fillet Weld .035 Dia. Sil Bronze, spot weld .034 & .028 galvanized steel			
20	LAP	VERT	Fillet Weld .035 Dia. Sil Bronze, spot weld .034 & .028 galvanized steel			
21	LAP	OVER-HEAD	Fillet Weld .035 Dia. Sil Bronze, spot weld .034 & .028 galvanized steel			

* Indicates that the student did not complete this lesson.

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WELDTECH Skill Achievement Form

tudent's Name _____ Soc.Sec.No. _____

Class STERLING HEIGHTS ASSEMBLY PLANT

ɪsson Ɔo.	Joint	Posit-ion	Exercise	Start Date	Complet-ion Date	Performance Level *
1			Introduction to Preventive Maintenance (Lecture)			
2			Change wire drive rolls			
3			Adjust and/or replace nylon wire guide tube			
4			Adjust wire drive roll tension			
5			Reload feeder with new wire spool			
6			Replace gas nozzle and insulator			
7			Replace contact tips			
8			Replace gun trigger switch			
9			Change gun liner			

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EXHIBIT F

WELDTECH WRITTEN TESTING

PRODUCTION WELDING

KNOWLEDGE CHECK

(PRE/POST TEST)

DIRECTIONS: For each of the following statements, select the answer that is most correct and write the proper letter (a, b, c, or d) in the blanks provided on the left.

_____ 1. In Gas Metal Arc Welding, the heat of the electric arc melts the _____ and the _____ so that they combine to form a bonded joint which is stronger than the original metal.

A. Electrode wire, base metal
B. Coated metal, uncoated metal
C. Contact tip, liner
D. None of the above

_____ 2. Which of the following items is not required for Gas Metal Arc Welding?

A. Constant voltage power cource
B. Continuous wire-feed mechanism
C. Oxyagen and acetylene cylinders
D. Welding gun, work lead, and electrode wire

_____ 3. In the GMAW process, what controls can the Quality Operator adjust?

A. Voltage control
B. Amperage control
C. Wire feed control
D. Both A and C

_____ 4. What type of power source is used for MIG Brazing on thin metals?

A. Constant current
B. Pulsed arc constant current
C. Constant voltage
D. Pulsed arc constant voltage

_____ 5. What effect do travel speed variations have?

A. Too high a travel speed causes uneven and poor penetration
B. Too slow a travel speed results in burn through
C. Both A and B above
D. None of the above

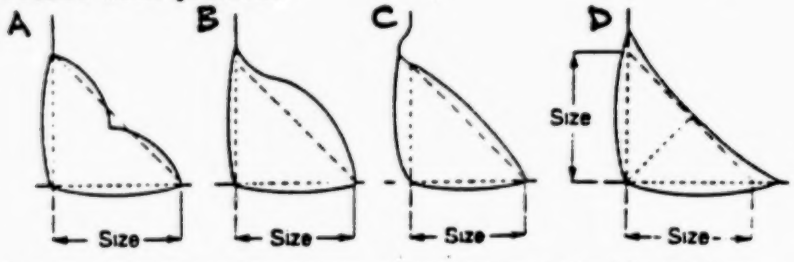
_____ 6. The two main types of flux-cored wire are:

A. Gas shielded and Argon shielded
B. Protective shielded and self shielded
C. Gas shielded and self shielded
D. Protective shielded and Argon shielded

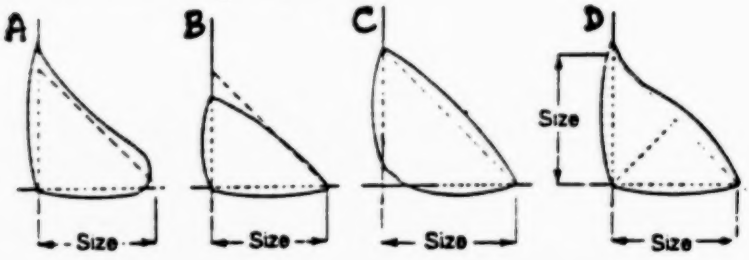
_____ 7. Which of the following is an advantage of the self shielded flux-cored process?

A. Can be used on coated metals
B. Operates in all positions
C. No flux feeding systems or gas bottles required
D. All of the above

_____ 8. Which drawing below show the most acceptable flux-cored fillet weld profile?



_____ 9. Which drawing below shows the most acceptable MIG Brazed fillet weld profile?



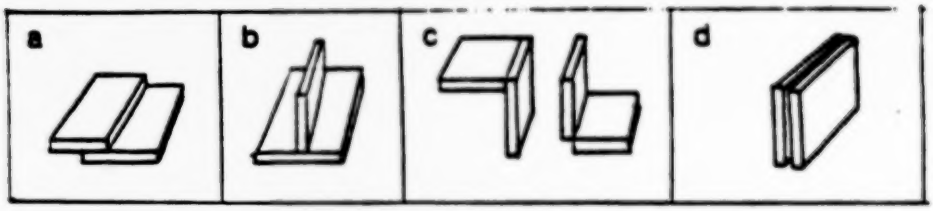
_____ 10. Welding is used to _____ two pieces of metal.

A. Crack
B. Oxidize
C. Join together
D. All of the above

_____ 11. The four welding positions are:

A. Flat, horizontal, vertical, and overhead
B. Straight, round, square, and curved
C. Up, down, forward, reverse
D. Flat, horizontal, vertical, and upside down

_____ 12. Which of the following drawings is an example of a lap joint?



_____ 13. The drawing below is an example of a weld in the _____ position.

A. Flat
B. Horizontal
C. Vertical
D. Overhead

DIRECTIONS: Mark the following statements T (for True) or F (for False) by drawing a circle around the letter you select.

T F 14. It is not recommended that the Quality Operator wear safety glasses under their welding helmet, since the helmet is equipped with safety filter glass.

T F 15. When welding galvanized metals in a confined area, it is necessary to wear a welding helmet which has a fresh air supply.

T F 16. To obtain a stable arc, the Quality Operator must adjust for proper voltage settings in comparison to the wire feed speed.

T F 17. Flux core is basically done in the flat and horizontal positions.

T F 18. "Melt-through" and "whiskers" are two characteristics of high quality welds.

T F 19. For MIG Brazing, the background selector switch should always be in the normal mode.

T F 20. During actual welding, the voltage meter whows the same voltage reading as it does when you check the peak voltage.

T F 21. Pulsed spray transfer uses low currents so it is often applied where "burn through" is a problem.

T F 22. Spray transfer is associated primarily with the use of non-inert gases.

DIRECTIONS: Match each difinition below with the correct welding term from the right column. Write the proper letter in the blank space provided.

_____ 23. Particles (or "bb's") given off during welding which do form part of the weld.

_____ 24. A weld used for lap and tee joints.

_____ 25. A device used to transfer current and guide the electrode into the arc.

_____ 26. Prevents porosity from forming in weld metal.

A. Fillet
B. Joint
C. Shielding
D. Gun
E. Spatter
F. Base Metal
G. Spray Transfer
L. Groove

DIRECTIONS: Match the terms listed to their location on the drawing below. Write the correct letters in the blanks provided at the left.

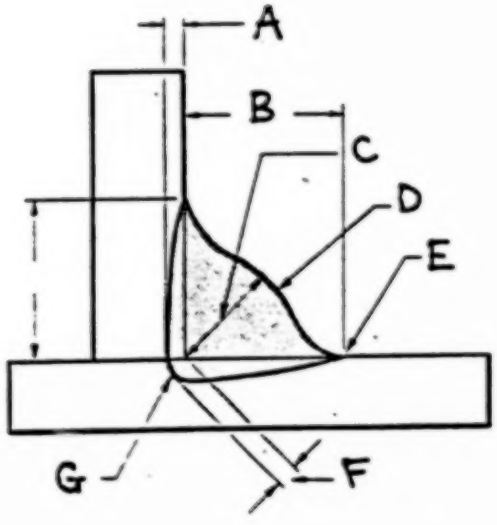
_____ 27. leg

_____ 28. toe

_____ 29. throat

_____ 30. root

_____ 31. face



DIRECTIONS: Match the welding terms listed below with their location in the drawing shown. Write the proper letter in the blanks provided.

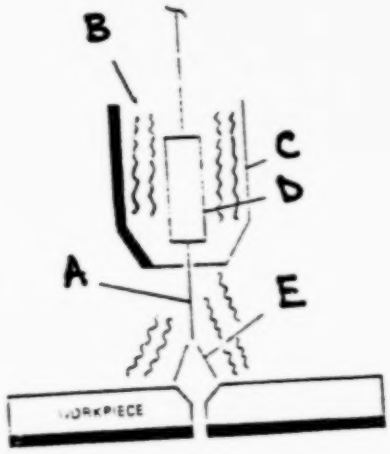
_____ 32. Shielding gas

_____ 33. Contact tip

_____ 34. Electrode wire

_____ 35. Arc

_____ 36. Nozzle



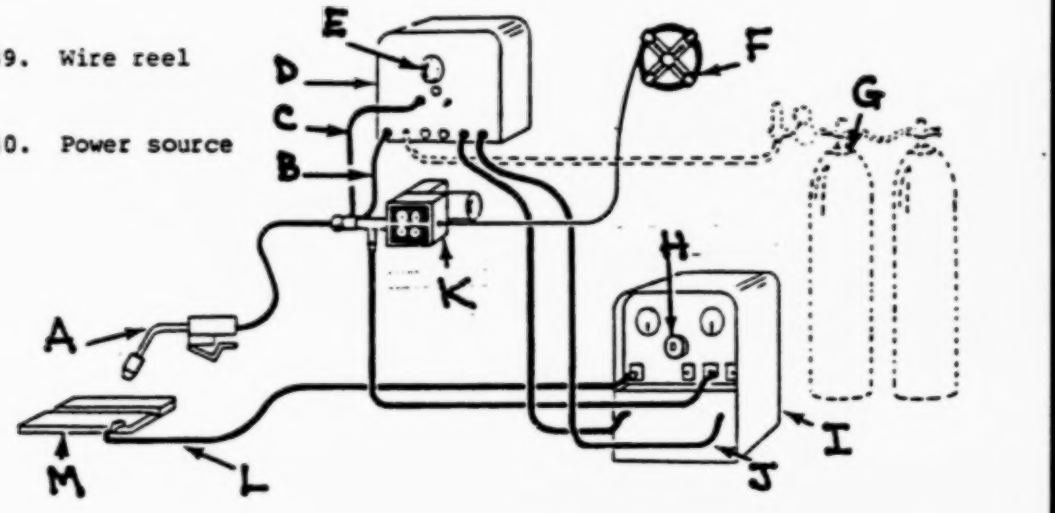
DIRECTIONS: Match the names of Flux-Cored welding equipment listed below to their location at the welding station shown. Write the proper letter in the blanks provided.

_____ 37. Shielding gas

_____ 38. Gun

_____ 39. Wire reel

_____ 40. Power source



KNOWLEDGE CHECK #1

INTRODUCTION TO GAS METAL ARC WELDING

DIRECTIONS: For each of the following statements, select the answer that is most correct and write the proper letter (a, b, c, or d) in the blanks provided on the left.

_____ 1. In Gas Metal Arc Welding, the heat of the electric arc melts the _____ and the _____ so that they combine to form a bonded joint which is stronger than the original metal.

A. Electrode wire, base metal
B. Coated metal, uncoated metal
C. Contact tip, liner
D. None of the above

_____ 2. The Gas Metal Arc Welding process is also sometimes referred to as:

A. CO2 welding
B. MIG welding
C. Both of the above
D. Neither of the above

_____ 3. Which of the following items is not required for Gas Metal Arc Welding?

A. Constant voltage power cource
B. Continuous wire-feed mechanism
C. Oxygen and acetylene cylinders
D. Welding gun, work lead, and electrode wire

DIRECTIONS: From the list below, select the "seven essentials" necessary for proper Gas Metal Arc Welding. Write the letters of the items you select in the blanks provided.

_____ 4.

_____ 5.

_____ 6.

_____ 7.

_____ 8.

_____ 9.

_____ 10.

A. Correct amperage (or inches of wire per minute)

B. Correct electrode

C. Correct distortion

D. Correct nozzle angle

E. Correct brand of welding equipment

F. Correct equipment manual

G. Correct type of oxyacetylene cylinders

H. Correct wire stickout

I. Correct voltage

J. Correct gas type and amount

K. Correct plasma arc gun

L. Expensive schooling

M. Correct travel speed

DIRECTIONS: Match the names of the controls listed below to their location on the welding machine shown. Write the proper letter in the blanks provided.

_____ 11. Power Switch (on/off)

_____ 12. Background voltage switch (raise/lower)

_____ 13. Voltmeter switch (peak/average/background)

_____ 14. Voltmeter

_____ 15. Pulse width control

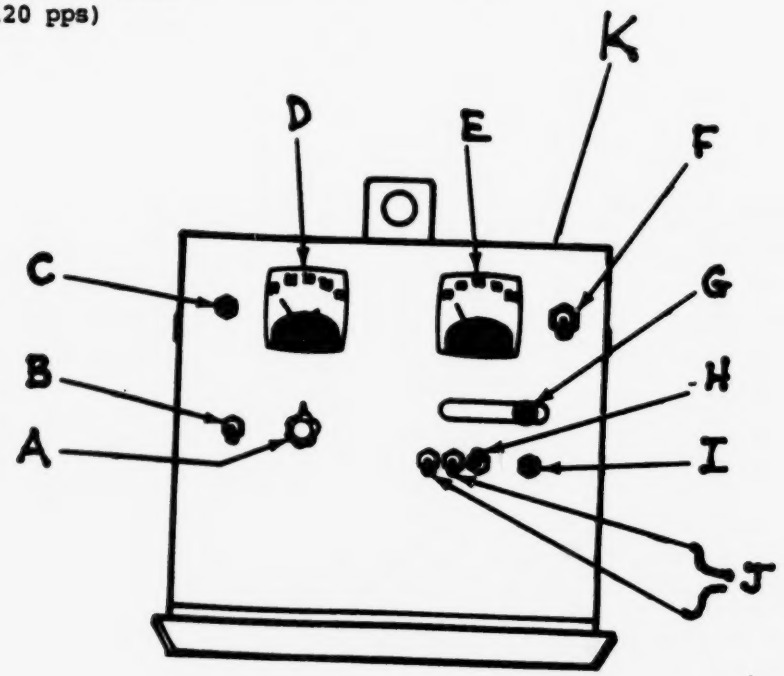
_____ 16. Power source

_____ 17. Background selector switch (extra low/normal)

_____ 18. Resistor switches (+8.5A/off)

_____ 19. Ammeter

_____ 20. Pulse rate switch (60/120 pps)



KNOWLEDGE CHECK #2

SAFETY AND HEALTH OF WELDERS

DIRECTIONS: Mark the following statements T (for True) or F (for False) by drawing a circle around the letter you select.

T F 1. It is not recommended that the Quality Operator wear safety glasses under their welding helmet, since the helmet is equipped with safety filter glass.

T F 2. Welding can be done safely if the Quality Operator stays alert, to possible dangers and remembers to always wear correct eye, ear, and body protection for the welding being done.

T F 3. When welding galvanized metals in a confined area, it is necessary to wear a welding helmet which has a fresh air supply.

T F 4. Some of the major hazards in welding include burns, glare, electrical shocks, and harmful fumes.

T F 5. Harmful fumes and gases are given off during the welding of all uncoated metals.

T F 6. Voltages used in welding are low and generally do not cause injury and severe shock; therefore, grounding of the welding machine and insulation of leads is not important.

T F 7. The electric arc produces a high intensity of ultraviolet and infrared rays which have harmful effects on the eyes and skin if left unprotected.

T F 8. To protect against painful burns the Quality Operator is advised to wear protective clothing, such as aprons, work gloves, and high-top shoes.

T F 9. It is not necessary to shield other people from the light rays produced by your welding arc if they are over 10 feet away.

T F 10. The selection of a proper safety filter glass can be done through a visual inspection.

KNOWLEDGE CHECK #3

GMAW PROCEDURES AND EQUIPMENT

DIRECTIONS: For each of the following statements, select the answer that is most correct and write the proper letter (a, b, c, or d) in the blanks provided on the left.

_____ 1. What type of power source is used for the GMAW process at Sterling Heights Assembly?

A. Constant Current
B. Constand voltage
C. Drooping voltage
D. Rising voltage

_____ 2. In the GMAW process, what controls can the Quality Operator adjust?

A. Voltage control
B. Amperage Control
C. Wire feed control
D. Both A and C

_____ 3. For Gas Metal Arc Welding the power source has a 100% duty cycle. This means the machine can be operated at _____ at its rated amperage.

A. 10 out of 10 minutes
B. 9.5 out of 10 minutes
C. Both A and B are correct
D. None of the above

_____ 4. What type of power source is used for MIG Brazing on thin metals?

A. Constant current
B. Pulsed arc constant current
C. Constant voltage
D. Pulsed arc constant voltage

_____ 5. What effect do travel speed variations have?

A. Too high a travel speed causes uneven and poor penetration
B. Too slow a travel speed results in burn through
C. Both A and B above
D. None of the above

DIRECTIONS: Mark the following statements T (for True) or F (for False) by drawing a circle around the letter you select.

T F 6. The term "wire stickout" refers to the amount of wire extending from the contact tip to the end of the wire (or beginning of the arc).

T F 7. As a general rule, after sufficient experience with the various modes of metal transfer, the trained eye of the operator becomes the best judge for setting proper arc lengths.

T F 8. Arc length controls weld quality because it affects penetration, bead hape, undercut, porosity, and spatter.

T F 9. Variations in wire stickout distance have no affect on the arc length.

T F 10. Weld penetration and the size of the weld bead generally are found to vary with the travel speed (in other words, the higher the travel speed, the more penetration and the larger the weld bead).

T F 11. The welding current determines the electrode melting rate and the penetration of weld metal into the workpiece.

T F 12. To obtain a stable arc, the Quality Operator must adjust for proper voltage settings in comparison to the wire feed speed.

T F 13. For good welding, the electrode must be clean, feed steadily, amd make uniform electrical contact within the contact tube.

KNOWLEDGE CHECK #4

THEORY OF FLUX-CORED WELDING

DIRECTIONS: For each of the following statements, select the answer that is most correct and write the proper letter (a, b, c, or d) in the blanks provided on the left.

_____ 1. The two main types of flux-cored wire are:

A. Gas shielded and Argon shielded
B. Protective shielded and self shielded
C. Gas shielded and self shielded
D. Protective shielded and Argon shielded

_____ 2. Which of the following is an advantage of the gas shielded flux-cored process?

A. Weld beads show even contour and minimum of spatter
B. Increased speed of welding
C. High travel speeds prevent heat buildup and minimize distortion
D. All of the above

_____ 3. Which of the following is an advantage of the self-shielded flux-cored process?

A. Can be used on coated metals
B. Operates in all positions
C. No flux feeding systems or gas bottles required
D. All of the above

DIRECTIONS: Mark the following statements T (for True) or F (for False) by drawing a circle around the letter you select.

T F 4. The major difference between gas-shielded and self-shielded flux-cored welding is the electrical stickout.

T F 5. The filler wire contains shielding, deoxidizing, and fluxing materials.

T F 6. Flux core is basically done in the flat and horizontal positions.

T F 7. Small diameter wires can be used in all positions.

T F 8. Reverse polarity penetrates deeper than straight polarity.

T F 9. Flux-cored welding requires a water cooled gun for all applications.

T F 10. Electrodes come in sizes from .045 to 1/8.

DIRECTIONS: Match the names of Flux-Cored welding equipment listed below to their location at the welding station shown. Write the proper letter in the blanks provided.

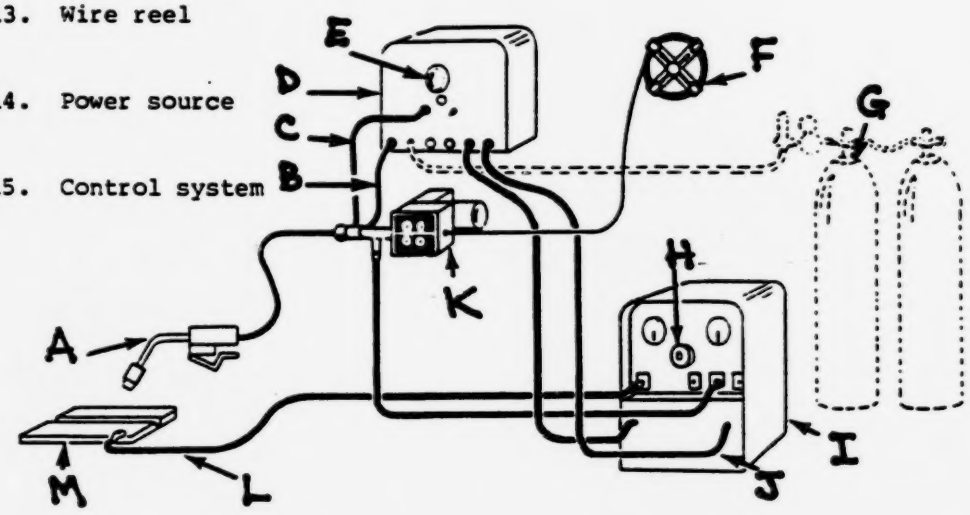
_____ 11. Shielding gas

_____ 12. Gun

_____ 13. Wire reel

_____ 14. Power source

_____ 15. Control system



PERFORMANCE CHECK #5

ADJUSTMENT OF FLUX-CORED EQUIPMENT

DIRECTIONS: Mark the following statements T (for True) or F (for False) by drawing a circle around the letter you select.

T F 1. The amperage only shows on the ammeter during actual welding.

T F 2. Amperage settings should always be adjusted before voltage settings.

T F 3. Amperage settings are regulate by the wire feed control.

T F 4. Welding voltage only shows on the voltmeter during actual welding.

T F 5. Voltage settings are regulated by the voltage control dial.

T F 6. When the current is higher, wire feed will be slower.

T F 7. If wire stickout is increased, the amperage is decreased.

DIRECTIONS: Match the welding terms listed below with their location in the drawing shown. Write the proper letter in the blanks provided.

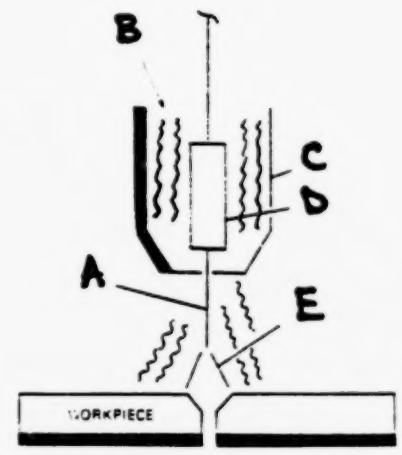
_____ 8. Shielding gas

_____ 9. Contact tip

_____ 10. Electrode wire

_____ 11. Arc

_____ 12. Nozzle



DIRECTIONS: Below are listed the three steps for adjusting the shielding gas flow setting. Number them in the correct order of adjustment (1, 2, and 3) in the blanks provided.

_____ 13. Press purge button on wire feed control.

_____ 14. Open valves on gas cylinder.

_____ 15. Adjust flow meter setting with thumbscrew.

DIRECTIONS: Complete the following statements by writing in the missing information in the blank spaces provided.

16. The decomposition of flux produces what kind of shielding gas? _____

17. What is the difference in self-shielding and externally shielding wires?

_____

18. What else besides providing a shielding gas does the flux core do?

_____

19. Give the AWS breakdown of the E-71-T-GS wire.

E _____ 7 _____ 1 _____ T _____

GS _____

20. The electrode wire stickout for the E-71-T-GS wire is _____ plus or minus 1/4".

KNOWLEDGE CHECK #6

WELD QUALITY CONTROL

DIRECTIONS: Mark the following statements T (for True) or F (for False) by drawing a circle around the letter you select.

T F 1. The quality of any weld depends almost entirely on porper machine settings.

T F 2. "Melt-through" and "whiskers" are two characteristics of high quality welds.

T F 3. Cracking in flux-cored welds is generally caused by rapid cooling or a highly restrained joint with no allowance for expansion.

T F 4. Excessive voltage, improper gun angle, and excessive travel speed are all causes of "undercutting."

T F 5. Quality fillet welds produced with the flux-cored process should blend smoothly into the base metal.

DIRECTIONS: For each of the following statements, select the answer that is most correct and write the proper letter (a, b, c, or d) in the blanks provided on the left.

_____ 6. In dealing with _____, the Quality Operator must be concerned with three specific properties of metal -- expansion, heat conductivity, and strength.

A. Visual inspection
B. Distortion
C. Both A and B
D. Neither A or B

_____ 7. When welding is done, distortion occurs because:

A. Tremendous heat is applied
B. Not enough heat is applied
C. Materials are of low quality
D. None of the above

_____ 8. Before welding, the Quality Operator _____ to anticipate certain shrinking and distortion problems.

A. Can do nothing
B. Would need at least ten years of experience
C. Should make a detailed shop drawing
D. Should pre-position his pieces

_____ 9. _____ is the most widely used and most valuable welding inspection technique, particularly for non-critical welding production.

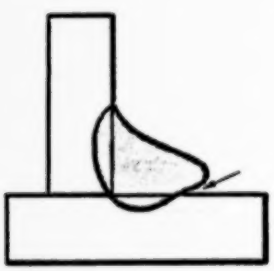
A. Radiographic Inspection
B. Visual Inspection
C. Ultrasonic Inspection
D. Magnetic Particle Inspection

_____ 10. The _____ has developed the widely-accepted specifications for the welding and inspection of sheet metal which Chrysler Corporation has adopted.

A. Airco Welding Products Co.
B. Sterling Heights Assembly Engineering Staff
C. American Welding Society
D. WeldTech School

_____ 11. The welding condition (shown by the arrow) in the drawing below:

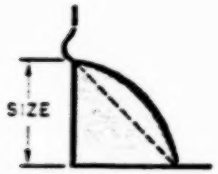
A. Is called "overlap"
B. Is a sign of poor fusion
C. Should be avoided because the joint is likely to fail under load
D. All of the above



_____ 12. Which drawing below illustrates the "undercut" defect in a fillet weld?

A

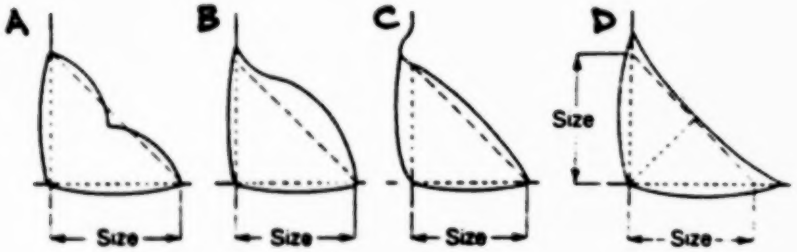
B



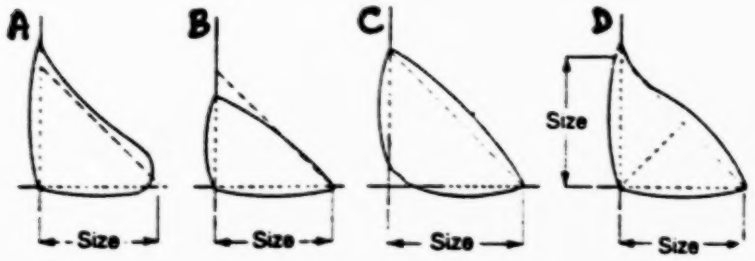
C

D

_____ 13. Which drawing below shows the most acceptable flux-cored fillet weld profile?



_____ 14. Which drawing below shows the most acceptable MIG brazed fillet weld profile?



DIRECTIONS: Match the terms listed to their location on the drawing below. Write the correct letters in the blanks provided at the left.

_____ 15. leg

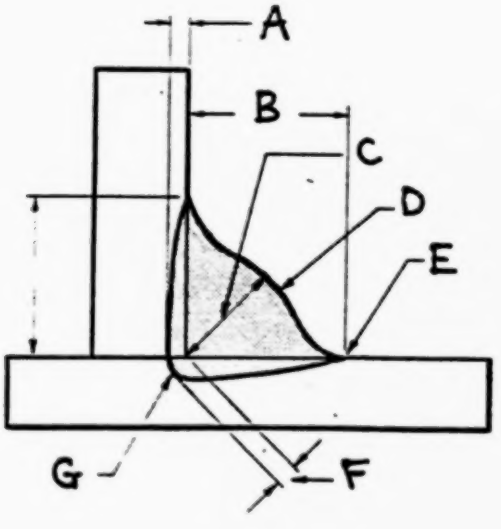
_____ 16. toe

_____ 17. throat

_____ 18. root

_____ 19. face

_____ 20. depth of fusion



KNOWLEDGE CHECK #7

GENERAL WELDING INFORMATION

DIRECTIONS: For each of the following statements, select the answer that is most correct and write the proper letter (a, b, c, or d) in the blanks provided on the left.

_____ 1. Welding is used to _____ two pieces of metal.

A. Crack
B. Oxidize
C. Join together
D. All of the above

_____ 2. Quality Operators use two major welding processes. They are:

A. Oxyacetylene welding and Shielded Metal Arc welding
B. Flux-cored welding and Pulsed-arc brazing
C. Gas Tungsten Arc welding and Plasma Arc welding
D. None of the above

_____ 3. Quality Operators will primarily perform _____and _____ joints.

A. Butt, edge
B. Corner, tee
C. Lap, butt
D. Lap, tee

_____ 4. The four welding positions are:

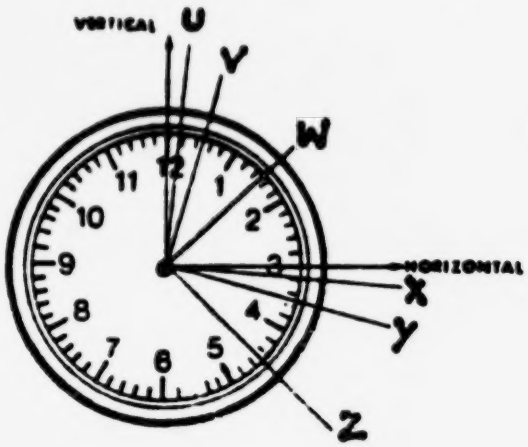
A. Flat, horizontal, vertical, and overhead
B. Straight, round, square, and curved
C. Up, down, forward, reverse
D. Flat, horizontal, vertical, and upside down

_____ 5. The angle of the electrode during welding is important since it affects:

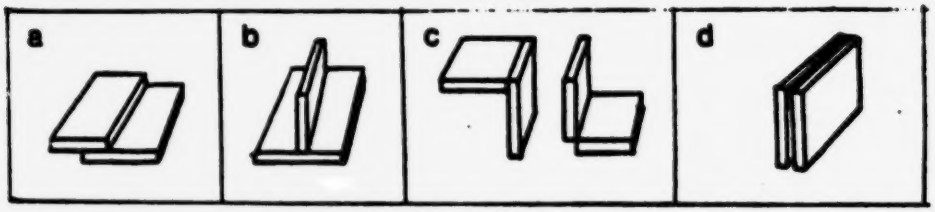
A. Penetration depth
B. Slag flow
C. Arc heat placement
D. All of the above

_____ 6. A clock face illustration can provide a reference for many of the electrode angles used in job practices. Angle Y shown below could be described as _____. NOTE: Compared to a clock face, 1 minute of time equals 6°.

A. 45° below horizontal
B. 15° from vertical
C. 5° below horizontal
D. None of the above

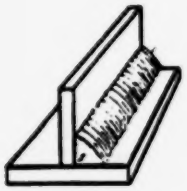


_____ 7. Which of the following drawings is an example of a lap joint?



_____ 8. The drawing below is an example of a weld in the _____ position.

A. Flat
B. Horizontal
C. Vertical
D. Overhead



DIRECTIONS: Match each definition below with the correct welding term from the right column. Write the proper letter in the blank space provided.

_____	9. Particles (or "bb's") given off during welding which do not form part of the weld.	A. Fillet
_____	10. A weld used for lap and tee joints.	B. Joint
_____	11. A device used to transfer current and guide the electrode into the arc.	C. Shielding
_____	12. Prevents porosity from forming in weld metal.	D. Gun
		E. Spatter
		F. Base Metal
		G. Spray Transfer
		L. Groove

KNOWLEDGE CHECK #8

ADJUSTMENT OF PULSED-ARC EQUIPMENT

DIRECTIONS: Mark the following statements T (for True) or F (for False) by drawing a circle around the letter you select.

T F 1. The 60/120 pulse switch indicates pulses per minute.

T F 2. The pulse width control, controls the peak voltage.

T F 3. It is a good idea to check the peak pulse voltage during actual welding.

T F 4. For MIG brazing, the background selector switch should always be in the normal mode.

T F 5. When the background selector switch is in the extralow mode, you should use the background voltage switch to raise or lower the background voltage.

T F 6. Both of the 8.5A and 17.A background voltage resistor switches should be turned into the on position when welding.

T F 7. During actual welding, the voltage meter shows the same voltage reading as it does when you check the peak voltage.

KNOWLEDGE CHECK #9

METAL TRANSFER AND THE PULSED-ARC SPRAY PROCESS

DIRECTIONS: Mark the following statements T (for True) or F (for False) by drawing a circle around the letter you select.

T F 1. Spray transfer is almost spatter free and provides deep penetration TO the base metal.

T F 2. Spray transfer is practically never used on 1/8" or thicker stock.

T F 3. With the pulsed arc welding process there are only two pulse selections -- 60 and 120 pulses per second.

T F 4. The short circuit transfer method allows for bridging of wide gaps, making it ideal where there is poor fit-up.

T F 5. Pulsed spray transfer uses low currents so it is often applied where "burn through" is a problem.

T F 6. The pulsed arc method is useful for welding thin-guage metal in all positions.

T F 7. In dip transfer welding, the welding current switches (or pulses) from a lower level (background current) to a higher level (pulse-peak current). Most of the energy required for transfer is supplied during the pulse.

T F 8. In Gas Metal Arc Welding, drops of molten metal are transferred from a continuously fed filler metal electrode to the work.

T F 9. Pulsed spray welding is an extension of Gas Metal Arc Welding which permits the GMAW welding process to be used with a shield of inert gas where lower average currents must be used.

T F 10. The term "globular" was adopted to designate transfer above the transition current because the shape of the arc at the electrode tip appears to be similar to the spray of water from a nozzle.

T F 11. Since sptay transfer is achieved in a shield of predominatly inert gas, the harmful effects of non-inert (reactive) gas on the metal being welded can be avoided.

T F 12. Spray transfer is associated primarily with the use of non-inert gases.

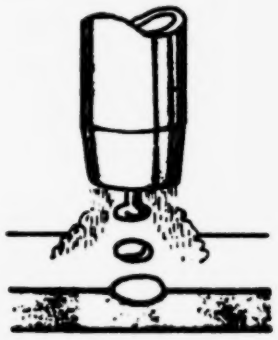
DIRECTIONS: Match the name of each type of metal transfer with the drawing below that illustrates it. Write the proper letters in the blanks provided.

_____ 13. Spray

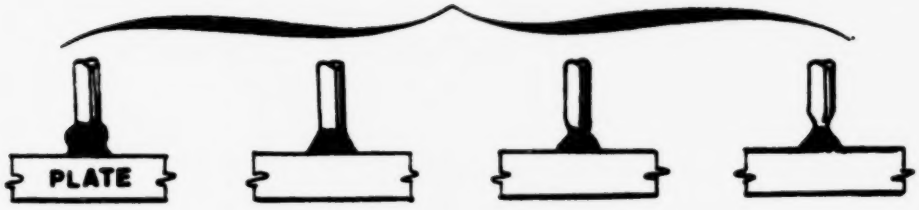
_____ 14. Globular

_____ 15. Short Circuit

A



B



C

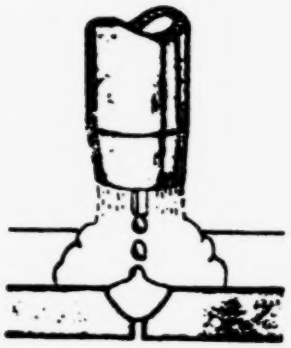


EXHIBIT G

SAMPLE TEXT MATERIAL

WELDTECH SERIES IN WELDING

Basic Gas Metal-Arc Welding

Student Workbook

CHRYSLER LEARNING INC.

Prentice-Hall, Inc., Englewood Cliffs, New Jersey 07632

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This 1983 edition published by Prentice-Hall Inc., Englewood Cliffs, NJ 07632

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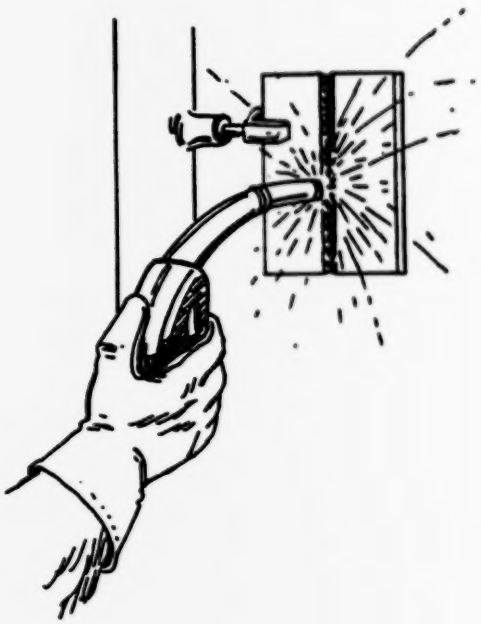
LESSON 1
INTRODUCTION TO MIG WELDING



OBJECTIVE:

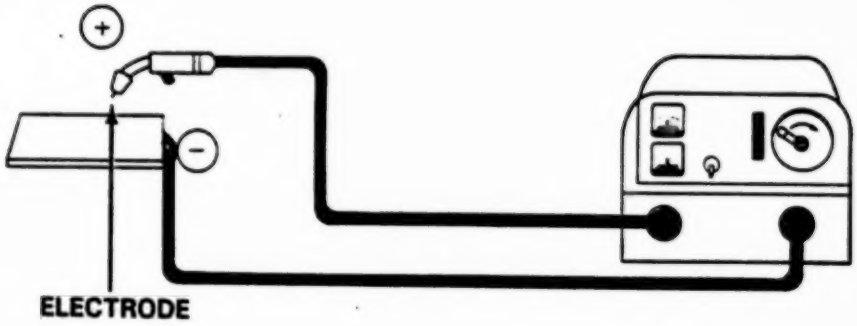
AFTER LISTENING TO AN INSTRUCTOR'S LECTURE, WATCHING AN AUDIO-VISUAL PRESENTATION, AND STUDYING THE INFORMATION IN THIS LESSON, YOU WILL BE ABLE TO CORRECTLY ANSWER TEST QUESTIONS ABOUT THE BASIC FUNDAMENTALS OF THE GAS METAL-ARC WELDING (GMAW) PROCESS.

You are about to begin learning a process of welding called Gas Metal-Arc Welding (GMAW). This process is also known as Metal Inert Gas, or MIG Welding, as it is commonly known. Welding is a process of joining two pieces of metal by heating to a temperature high enough to cause softening or melting, with or without pressure and with or without the use of a filler metal.

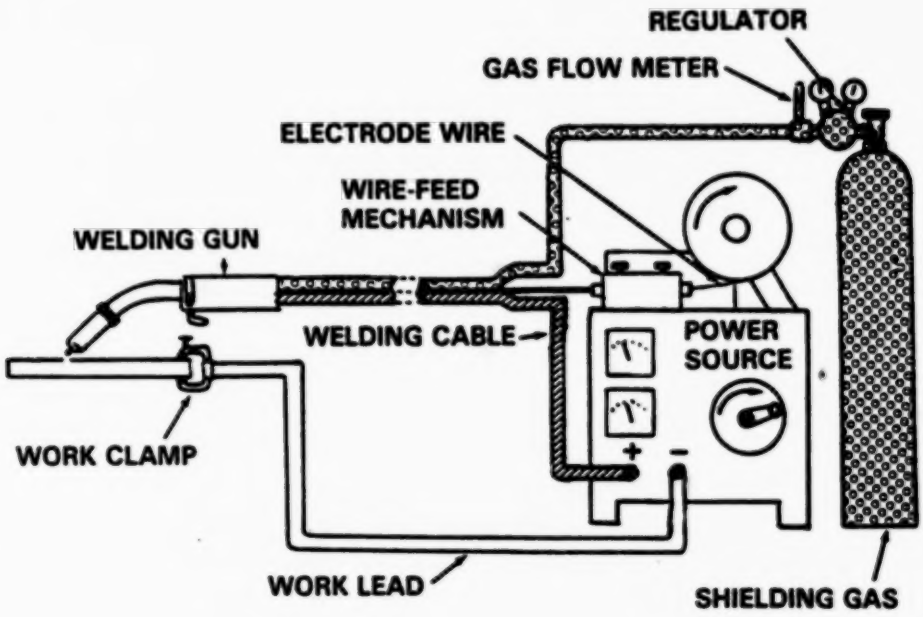
The welding industry has made tremendous progress in a short time and is continually growing and expanding to meet the needs of our highly industrialized society. You could look closely at almost everything you see in a day and find that, somehow, welding had a part in its creation. The buildings you live and work in were probably constructed in part by welding. Even the clothes you wear and the food you eat were most likely made and processed by machines that have been constructed and maintained by welding. The welding industry has contributed a great deal to raising our standard of living, and it needs more and more people to meet its ever growing demand.

Gas Metal-Arc Welding (GMAW) is becoming increasingly popular in the welding industry today. It is a continous wire-feeding process which was introduced into the industry during the 1950s. At that time, the process was limited by high cost, crude wire-feeding systems, and unsuitable welding machines for the MIG process. Because of the vast improvements made in the last 20 years, however, MIG welding is now considered to be one of the more flexible, all-around processes in the industry. It is used principally on carbon steel, stainless steel, low-alloy steel, aluminum, copper, magnesium, and nickel. The heat of the electric arc melts the electrode wire and the base metal so that they combine to form a bonded joint which is stronger even than the metal you started with.

The Gas Metal-Arc Welding process usually uses a constant voltage power source. Polarity is usually set at dc reverse. This means the electrode wire becomes positive (+) and the workpiece is negative (−).



Besides the constant voltage power source, other equipment needed for MIG welding includes: electrode wire, a work clamp, lead, a welding gun, a wire-feeding mechanism, and shielding gas and flow meter. You will also need a wire brush, wire cutters, and protective equipment such as a welding helmet, work gloves, safety glasses, and protective clothing.



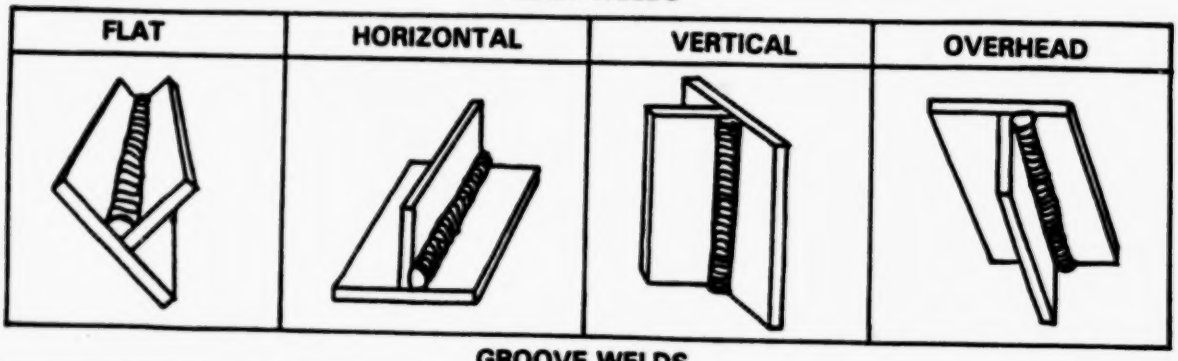
EQUIPMENT REQUIRED

DC POWER SOURCE | HELMET | GLOVES | PROTECTIVE CLOTHING | WIRE BRUSH | WIRE CUTTERS | SKULL CAP

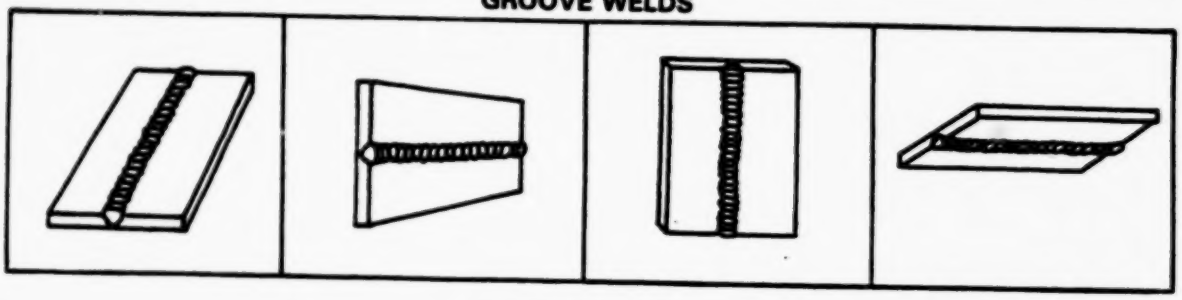
There are five basic joints to be concerned with in welding: lap, tee, corner, butt, and edge joints. These joints are illustrated below. The four welding positions you will learn are: flat, horizontal, vertical, and overhead.

WELDING POSITIONS:

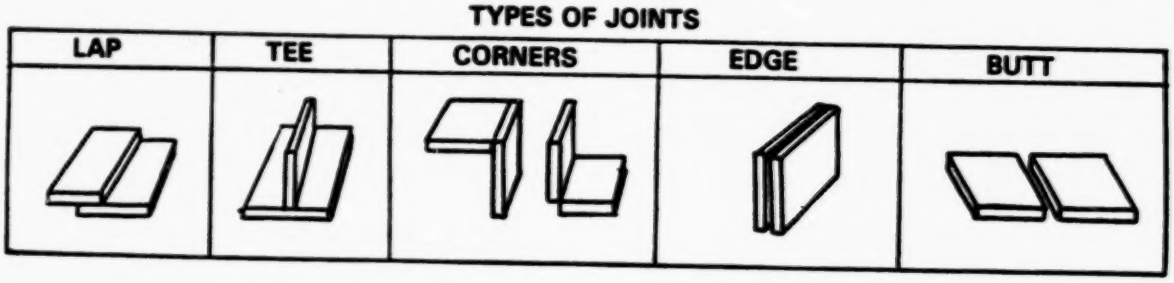
FILLET WELDS

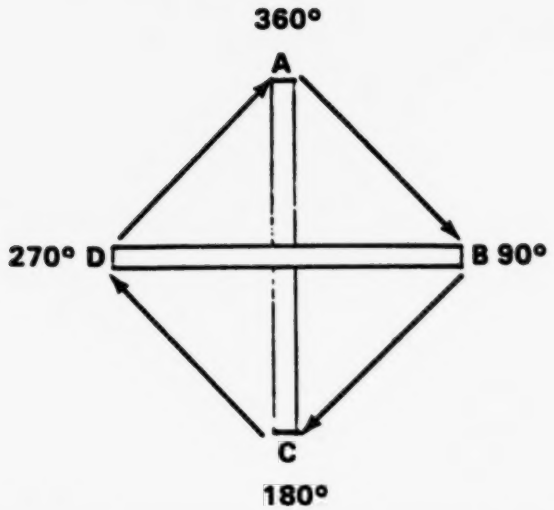


GROOVE WELDS



TYPES OF JOINTS

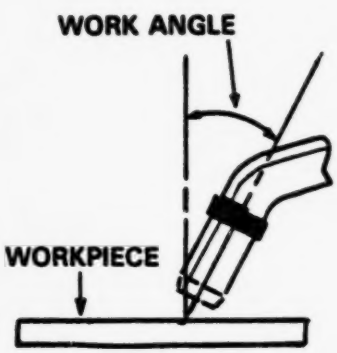


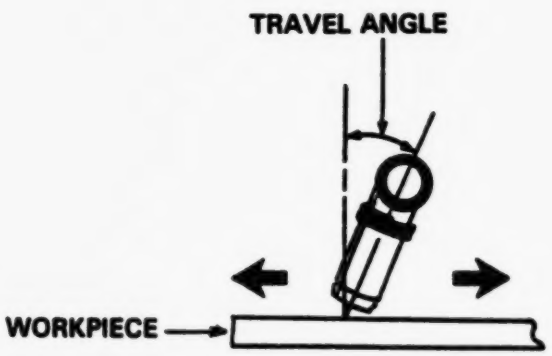


The many different joints, positions, and types of welds use various nozzle angles—which means the angle at which you hold the nozzle of the welding gun to the work, and the direction of travel. When figuring the nozzle angles, it is helpful to know that there are 360 divisions in a circle, and each division is called a degree:

From A to B is 90°.
From B to C is 90°.
From A to A is one complete revolution equalling 360°.

For proper welding techniques, a welder should know the torch and nozzle angles. Below are illustrations that will show you the difference between the work angle and the travel angle.





The appropriate nozzle angle is very important in making a good weld, as you will note by studying this list of the "seven essentials" necessary for proper welding:

1. Correct amperage or (inches of wire per minute).
2. Correct electrode.
3. Correct nozzle angle.
4. Correct electrode wire stickout.
5. Correct voltage (controls arc gap).
6. Correct gas type and amount.
7. Correct travel speed.

LESSON 2
SAFETY AND HEALTH OF WELDERS

OBJECTIVE:

AFTER LISTENING TO AN INSTRUCTOR'S LECTURE, WATCHING AN AUDIO-VISUAL PRESENTATION, AND STUDYING THE INFORMATION IN THIS LESSON, YOU WILL BE ABLE TO IDENTIFY THE MORE COMMON HAZARDS INVOLVED IN WELDING AND WHAT STEPS TO TAKE TO GUARD AGAINT THEM.

There are some hazards in electric welding processes a welder should take precautions against to ensure his own safety and the safety of other workers around him. The main hazards to be guarded against are: burns from sparks and molten metal, glare, electrical shocks, and harmful fumes.

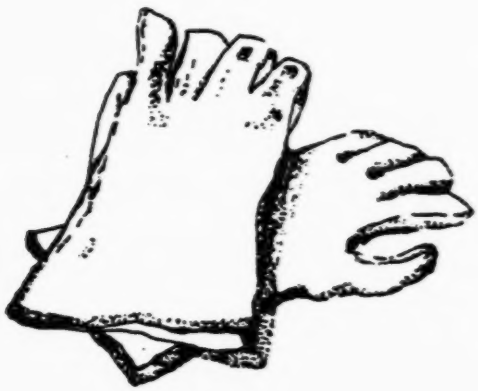
To protect against painful burns, the welder should wear protective clothing, such as leather jackets, aprons, work gloves, and caps. Trousers and jackets should have no cuffs which might catch flying sparks. Shoes with high tops to protect the ankles should be worn also. When welding in confined spaces or in the overhead position, it is advisable to shield one's ears by inserting wool or rubber plugs and covering them with wire screen protectors.

The electric arc produces a high intensity of ultraviolet and infrared rays which have harmful effects on the eyes and skin if not guarded against. Because of the intensity of these rays, the welder (and anyone observing the operation) must wear a helmet equipped with a filter glass to provide adequate eye protection. The helmet also protects the skin of the face and neck from the "sunburn" effect of the infrared rays. The slection of the filter glass must be done through laboratory testing since the intensity of the ultraviolet and infrared rays cannot be determined by visual inspection. Lens filters for electric arc welding are graded by a "shade number" ranging from 6 to 14, the darkest of which is 14. Selection of the proper lens depends on the welding process being used and the light sensitivity of the individual welder's eyes.

Voltages used in electric arc welding are low and generally do not cause injury and severe shock. However, to prevent any dangerous situations from arising, the welder should always check his welding machine to make sure it is properly grounded and that all the leads are properly insulated. Taking precautions against welding under any damp conditions will also prevent the likelihood of dangerous or severe electrical shock (i.e., wearing rubber boots when needed, refraining from using wet materials or equipment, etc.). Water-cooled holders for TIG and MIG welding must not be used if there are any water leaks.

Welders must also take precaution against harmful fumes and gases which are often emitted during the welding operation. Proper ventilation of the work area is essential for the safety and health of all persons within the area.

Safety in any occupation or activity often depends on the common sense of all involved. Each person is encouraged and expected to practice these "rules" of common sense for everyone's well being.



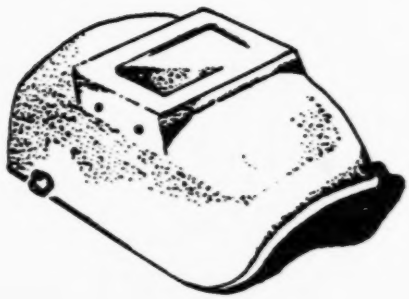


EXHIBIT H

MINUTES OF ADVISORY COMMITTEE MEETINGS

CHRYSLER LEARNING INC.

May 14, 1984

TO: See List Below

FROM: T. M. Lyons - Program Development Coordinator, WeldTech

SUBJECT: MINUTES OF ADVISORY COMMITTEE MEETING ON MODEL TRAINING PROJECT FOR DISPLACED WORKERS

E. Jacoby	M. Riess	C. Mitchell
D. Maxwell	W. Prokopy	R. Lynch
G. Knight	K. Winchester	P. Clayton
N. Opyd	R. Schneble	
T. Johnson	D. Manzi	

On Thursday, May 10, 1984, the Advisory Committee for this project held its first meeting at the Sterling Heights Assembly Plant (S.H.A.P.). Those present were:

P. Clayton - Instructor, WeldTech
G. Knight - School Director, WeldTech
R. Lynch - B-in-W Quality Operator, S.H.A.P.
T. Lyons - Program Development Coordinator, WeldTech
D. Manzi - Personnel Development Administrator, S.H.A.P.
C. Mitchell - On-Site Union Rep., S.H.A.P.
M. Reiss - Associate Director, Higher Educ. Mgmt. Services, Michigan Dept. of Educ.
R. Schneble - B-in-W Area Manager, S.H.A.P.

The meeting proceeded as follows:

- Copies of minutes from two prior meetings at S.H.A.P. were distributed by D. Manzi as an update for those persons not present during the earlier discussions about the Model Project for Displaced Workers.

- Every person present introduced themselves to the group.

- G. Knight described previous welding training provided for S.H.A.P. Quality Operators in recent months. He indicated that this Model Project is intended as an improvement on these efforts with additional training to be provided to help Quality Operators cope with such areas as preventive maintenance of their welding equipment.

- The purpose for this project was outlined by M. Reiss. The need for workers to acquire new skills due to changing technology requires that new training models be developed. It is hoped that WeldTech's training of Quality Operators at S.H.A.P. will result in such a model that may benefit other re-training efforts in the U.S.

- M. Reiss indicated that the only reporting requirement of the Dept. of Education for this project would be a final report to be prepared by WeldTech. It will describe the process of developing, implementing, and evaluating training. It should also describe trainee selection criteria for pilot group training. M. Reiss stated that the time period for this project is open and would be flexible to suit S.H.A.P. schedules.

- The scheduling of Pilot Group training for this project was discussed. Training of Pilot Group I, consisting of nine (9) Quality Operators, is currently scheduled for 270 hours to run June 4 through July 20, 1984. It was suggested that Pilot Group II might be scheduled prior to the implementation of a second shift operation (approx. Nov. 1984) for another nine (9) Quality Operators.

- The need to decide on trainee selection criteria for this project was discussed. The only Dept. of Education requirement is that trainees be displaced workers.

- Copies of a "Preliminary WeldTech Training Plan" were distributed and described by WeldTech staff present. This document provided an overview of proposed training activities aimed at specific welding job duties/tasks of the Quality Operators at S.H.A.P. It was pointed out that trainee evaluation would consist of written testing (limited) and visual inspection of welds made according to American Welding Society specifications.

- There was a discussion of preventive maintenance training topics to be provided. C. Mitchell brought up the point that Quality Operators must be allotted sufficient time to perform this type of maintenance in addition to their normal production tasks. It was agreed that preventive maintenance to be taught by WeldTech would consist primarily of items which could be accomplished in a short time period, such as changing the nozzle or contact tips on the welding gun. A further benefit of this type of training is the opportunity for Quality Operators to identify equipment problems before they have a chance to affect quality of welds.

- The committee agreed to designate M. Reiss and G. Knight as Co-Chairpersons and T. Lyons as Secretary.

- The next meeting of the full Advisory Committee was scheduled for Wednesday, May 30, 1984, and the following assignments were made:

  - D. Manzi, R. Schneble, C. Mitchell and R. Lynch would determine trainee selection criteria for Pilot Group I prior to next meeting.

  - At next meeting, G. Knight, T. Lyons, and P. Clayton would provide additional details on training planned. Specifically this would include sample written tests, description of AWS weld specifications, detailing of preventive maintenance to be taught, and recommendations for training sites to be used (i.e., length of training time at WeldTech and at S.H.A.P.).

Thomas Lyons

Thomas Lyons

TL/dmb

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WELDING EDUCATION CENTER
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DETROIT MI 48205
TEL 313 267 3385

CHRYSLER LEARNING INC.

June 7, 1984

TO: See List Below

FROM: T. M. Lyons, Program Development Coordinator, WeldTech

SUBJECT: MINUTES OF ADVISORY COMMITTEE MEETING ON MODEL TRAINING PROJECT FOR DISPLACED WORKERS

E. Jacoby	M. Reiss	C. Mitchell
D. Maxwell	W. Prokopy	R. Lynch
G. Knight	K. Winchester	P. Clayton
N. Opyd	R. Schneble	B. Brunn
T. Johnson	D. Manzi	

On Wednesday, June 6, 1984, the Advisory Committee for this project held its second meeting at the Sterling Heights Assembly Plant (S.H.A.P.). Those present were:

P. Clayton - Instructor, WeldTech
G. Knight - School Director, WeldTech
T. Lyons - Program Development Coordinator, WeldTech
D. Manzi - Personnel Development Administrator, S.H.A.P.
M. Reiss - Associate Director, Higher Education Management Services, Michigan Department of Education
R. Schneble - B-in-W Area Manager, S.H.A.P.

The meeting proceeded as follows:

- A list of nine (9) trainees selected for June 11 pilot group training was distributed. D. Manzi highlighted the fact that these individuals were all displaced from Chrysler plants for a significant period of time before being hired by S.H.A.P. in early 1984.
  The list also included such information as their previous job classification, previous plant location, and last date worked (at previous plant). In response to a question from M. Reiss, it was stated by D. Manzi that the majority of S.H.A.P. Quality Operators in B-in-W area were previously employed by

Chrysler at either the Hamtramck or Lynch Road Assembly plants; thus explaining the fact that all nine (9) trainees have one of these locations listed as their previous plant. D. Manzi also offered to provide any additional information needed by WeldTech to train and/or evaluate persons in the June 11 pilot group.

- A package of WeldTech teaching materials was then distributed. A discussion took place with regard to the reading level required of WeldTech's training materials (tests, texts, etc.) and their appropriateness for the S.H.A.P. trainees. G. Knight stated that learning at WeldTech is not totally dependent on student reading abilities. Rather, a four-step teaching technique is used which consists of lectures, demonstration, written testing, and "hands-on" skill performance/evaluation. P. Clayton added that if any individual had reading difficulties, the tests would be read aloud to them. T. Lyons pointed out that training emphasis was primarily on achievement of "hands-on" welding skills learned via practice and instructor coaching. R. Schneble and D. Manzi described in-plant safety training and procedures used to address the reading comprehension problem, such as illustrated Operation Description Sheets, "Safety of the Work Environment" presentations, and the S.H.A.P. Safety Committee.

- The training schedule for the June pilot group was reviewed and approved. Training will start on June 11, 1984 at WeldTech and will run Monday through Friday for six (6) weeks. It will be scheduled from 6:30 a.m. to 3:00 p.m. (with 1/2 hour for lunch) each training day. Maps with directions to WeldTech will be provided to each trainee as well as a description of protective clothing requirements. Mr. Brian Brunn has been selected as the instructor. He will visit S.H.A.P. between June 6 and June 8 to familiarize himself with plant welding requirements and meet trainees prior to program start.

  After their training at WeldTech, trainees will return to S.H.A.P. where a WeldTech instructor will provide thirty (30) hours of in-plant follow-up to ensure that welding skills are properly applied under production conditions and to generally evaluate the effectiveness of the training provided at WeldTech.

- A description of preventive maintenance skills to be taught by WeldTech was distributed and discussed. P. Clayton indicated that the main purpose of teaching this subject was to increase the awareness of Quality Operators as to typical equipment malfunctions in an effort to keep them from making defective welds as a result of continuing to use faulty equipment. R. Schneble indicated that no final determination

has been made yet as to what, if any, specific p.m. tasks a Quality Operator might perform on-the-job at S.H.A.P.

- G. Knight shared the "Attendance and Progress Report" form used at WeldTech. The student receives feedback on attendance and skill performance at least weekly and signs the form to indicate that they are aware of their progress and any areas that need improvement. R. Schneble agreed that this form was a valuable tool to help motivate individual students and indirectly promote the goal of "team spirit" among Quality Operators at S.H.A.P.

- The next meeting of the Advisory Committee was scheduled for Wednesday, July 11, 1984 at 10 a.m. in S.H.A.P. Conference Room. Progress of pilot group training will be evaluated and discussed at that time.

Thomas Lyons

Thomas Lyons

TL/dmb

CHRYSLER LEARNING INC.

July 12, 1984

TO: SEE LIST BELOW

FROM: T.M. Lyons - Program Development Coordinator, MoTech Educational Centers

SUBJECT: MINUTES OF ADVISORY COMMITTEE MEETING ON MODEL TRAINING PROJECT FOR DISPLACED WORKERS

E. Jacoby	T. Johnson	R. Schneble
D. Maxwell	M. Reiss	D. Manzi
G. Knight	W. Prokopy	C. Mitchell
N. Opyd	K. Winchester	R. Lynch

On Wednesday, July 11, 1984, the Advisory Committee for this project held its latest meeting at the Sterling Heights Assembly Plant (S.H.A.P.). The purpose of the meeting was to have WeldTech personnel give a progress report on the status of Pilot Group I training currently in-progress at the school. Those persons present were:

B. Brunn - Instructor, WeldTech
E. Jacoby - Director, Chrysler Institute
T. Johnston - Personnel Administrator, S.H.A.P.
G. Knight - School Director, WeldTech
T. Lyons - Program Development Coordinator, MoTech Educational Centers
M. Reiss - Associate Director, Higher Education Management Services, Michigan Dept. of Education
R. Schneble - Body-In-White Area Manager, S.H.A.P.

The meeting proceeded as follows:

- Brian Brunn, the WeldTech Instructor for Pilot Group I training, provided an update on the progress of the nine trainees as of Week 5 of the program. He presented a chart detailing the accomplishments of each trainee in the areas of "Objectives/Lessons Completed," "Average Percentage Scores on Written Tests," "Attendance," "Learning Ability," and "Dependability." He was able to report excellent progress in all of these areas. He mentioned a number of teaching techniques being used at WeldTech to improve the effectiveness of training, such as weekly student skill competitions, welding on various simulated body positions to duplicate S.H.A.P. job requirements, use of timed tests to help increase student speed skills, and qualification of students to A.W.S. and Chrysler weld specifications. Brian also reported that students did not seem to be experiencing any reading difficulties with WeldTech's written tests. Training at WeldTech will be completed July 20 with follow-up training at S.H.A.P. during the week of July 23-27.

- Glen Knight, Director of WeldTech, explained in more detail the process of certifying/qualifying the trainees to welding specifications of A.W.S. and Chrysler. This procedure involves visual inspection and mechanical bend testing of each trainee's weld samples according to established criteria. Advantages of qualifying trainees are threefold: trainee accomplishments are recognized since they receive a certificate and wallet card attesting to their demonstrated skills, trainees will gain an awareness of the importance of weld quality and integrity of workmanship, and trainees will have an official record of additional skills recognized throughout the various sheet metal industries. The last advantage would become particularly significant, if they were ever displaced again as it would greatly improve their chances for employment in other companies doing similar sheet metal welding.

- T. Lyons, Program Development Coordinator for the MoTech Schools, described the various evaluation procedures/instruments planned in conjunction with this Model Project. These will include different types of student surveys, pre/post testing, a number of written quizzes, student attendance and progress reports, skill achievement (performance) documentation, qualification/certification of student welds, in-plant feedback from supervision on training effectiveness, and various means for analyzing test results to improve the validity and reliability of test questions used in conjunction with the program.

As part of the general discussions that followed, several additional points were made:

- M. Reiss indicated that certification/qualification of welders would be helpful in documenting program results for the "traditional" education community.

- R. Schneble and T. Johnston stated that Pilot Group II training would be conducted sometime prior to March 1985, dependent upon whether or not a second shift is to be added by that date. M. Reiss indicated that the Department of Education was flexible in regard to scheduling of Pilot Group II.

- E. Jacoby announced that tentative approval for this program had been given by U.S. Department of Education with funding level to be approximately $90,000.

- R. Schneble and T. Johnston expressed an interest in having Pilot Group I's graduation ceremony videotaped. T. Lyons suggested that scenes showing training at WeldTech and welding activity at S.H.A.P. also be filmed. E. Jacoby stated that Fenton Ludtke, who handles public relations for Chrysler Institute, would assist in this effort.

- The next meeting of the Advisory Committee will be scheduled for the early part of August to study final results of Pilot Group I training. T. Lyons will contact committee members to confirm a specific date, time, and place.

Thomas Lyons

TL/clg

MoTech EDUCATIONAL CENTERS

WELDTECH
WELDING EDUCATION CENTER
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313 267-3385

CHRYSLER LEARNING INC.

March 8, 1985

TO: SEE LIST BELOW

FROM: T.M. Lyons - Program Development Coordinator - MoTech Educational Centers

Minutes of 12/19/84 Advisory Committee Meeting on Model Training Project for Displaced Workers and Current Status Update

D. Maxwell	C. Mitchell
G. Knight	E. Lattimore
M. Reiss	C. Doan

MEETING MINUTES

On Wednesday, December 19, 1984, the Advisory Commitee for this project funded by the Department of Education held its latest meeting at the Sterling Heights Assembly Plant (S.H.A.P.). The purpose of the meeting was to review final results of Pilot Group I training, discuss curriculum revisions needed, and finalize plans for implementation of Pilot Group II training to be conducted by WeldTech. Those persons present were:

Chris Doan - Personnel Development Administration, SHAP
Glen Knight - School Director, WeldTech
Earl Lattimore - Area Manager, Body Shop SHAP
Tom Lyons - Program Development Coordinator, WeldTech
Clarence Mitchell - On-Site Union Rep., SHAP
Mary Reiss - Assoc. Director, Higher Education Mgmt. Services, MI Dept. of Education

Major items discussed/decided were as follows:

*Glen Knight and Tom Lyons reviewed trainee performance results of Pilot Group I training, including charts illustrating that:

a. All nine students showed improvement based on their pre/post test scores
b. Whereas 2/3 of students scored 25% or less on pre-test (two less/over 2/5 than 5%) and nobody scored higher than 75%. The post-test results showed of students scored 75% or better, over 2/5 scored 50% or better and nobody scored less than 40%.
c. Post-test average score of 71% was 44 percentage points improved from pre-test average score of 27%.
d. Results on post-test ranged from 43% up to 84% as opposed to pre-test range of 2% to 74%.
e. Scores improved (post vs. pre-tests) from 10 - 80 percentage points.
f. A number of trainees were certified/qualified in various aspects of the major welding processes taught, as follows:

- Seven (7) quailifed in Flux-Cored Arc Welding
- Five (5) qualified in Gas Metal Arc Welding

*The Advisory Committee decided that two major changes should be incorporated into Pilot Group II training, as follows:

a. Increase the amount of in-plant training time (during seven-week training period) from one week to two weeks. Five weeks of training would still be conducted at the WeldTech school.

b. Provide trainees with the same protective helmets used at SHAP so they might have an opportunity to become accustomed to wearing this equipment and working under the same conditions as found in the plant.

*Chris Doan set up a firm schedule for Pilot Group II training, as follows:

a. Prior to January 7, 1985, SHAP supervision would select nine trainees, who had been displaced from other Chrysler Plants and rehired at Sterling (possessing no or only minimal welding skills).

b. Classroom and hands-on training would take place for five weeks at WeldTech, from January 7 through February 8, 1985.

c. In-plant coaching under supervision from WeldTech instructor would take place for two weeks, from February 11 through February 21, 1985.

*The next meeting of the Advisory Commitee (including a tour of SHAP Weld Booth) was tentatively scheduled for February 15, 1985.

STATUS UPDATE

Due to scheduling conflicts, the Advisory Committee did not meet in February as planned. Therefore, this update is provided for informational purposes.

Since the 12/19/84 meeting of the Advisory Committee, training of Pilot Group II has been implemented.

Based on input from SHAP supervision (who felt that more than two weeks of training in-plant was required) training at WeldTech was shortened to three weeks, with the remaining four weeks reserved for inplant coaching of trainees by a WeldTech instructor on the moving assembly line at SHAP.

As a result of performance evaluations at WeldTech and SHAP, it was determined by the instructor that three of the oringinal nine trainees failed to demonstrate adequate skill progress (one trainee was 6'8" tall and had difficulty positioning himself properly on the moving line to perform the required welds). Those three trainees were assigned other tasks and replaced with three additional trainees (all displaced workers) who were provided with training for the remainder of the scheduled period. The end result was nine successfully trained welders who passed all required performance tests and are performing as welders on the second shift at SHAP.

Currently WeldTech is compiling data on the performance of trainees in Pilot Group II and comparing results to those for Pilot Group I trainees. WeldTech also plans to conduct a follow-up on all 21 trainees who participated in this program. Final project results will be discussed with the Advisory Committee in the near future prior to the completion of a Final Report covering all phases of this project.

Thomas Lyons

Thomas Lyons, Coordinator
Program Development & Technical Proposals

/clg

EXHIBIT I

WELDTECH STUDENT EVALUATION FORM

STUDENT'S NAME | INSTRUCTOR | COURSE | SHIFT

WeldTech STUDENT ATTENDANCE & PROGRESS REPORT

CODE

A	- Absent	P	- Placed
CC	- Class Completed	PC	- Program Completed
E	- Excused	SP	- Suspended
H	- Holiday	T	- First Day Training
HE	- Home Early	AT	- Needs Add'l Training
IS	- In Service	NC	- Needs Counselling
L	- Late	S	- Satisfactory
LA	- L-Of-Absence	U	- Unsatisfactory
O	- Terminated		

ENTER APPROPRIATE CODE

Week	1	2	3	4	5
SAFETY HABITS					
USE OF TIME					
CARE OF EQUIPMENT					
USE OF MATERIALS					
MANUAL DEXTERITY					
CLASSROOM PARTICIPATION					

ATTENDANCE (Enter Code)

Mon. Date	M	T	W	T	F

CHECK APPROPRIATE BOX

INDUSTRY ENERGY — Week	1	2	3	4	5
Lacks Motivation					
Average					
Hard Worker					
Very Diligent					
RELATIONS WITH OTHERS					
Difficult to Work With					
Sometimes Uncommunicative					
Mostly Co-operative					
Always Congenial & Co-operative					
ACADEMIC LEARNING ABILITY					
Lacks Comprehension					
Learns Slowly					
Average					
Above Average					
DEPENDABILITY					
Needs Constant Watching					
Sometimes Unreliable					
Responsible					
Very Dependable					

MAJOR COMPENTENCY AREAS

Directions
Evaluate the Trainee using the rating scale below and check the appropriate number to indicate the degree of competency. The numerical ratings of 4,3,2 and 1 are NOT intended to represent the traditional school grading system of A,B,C and D. The descriptions associated with each of the numbers focus on the level of student performance for each of the tasks.

RATING

4 - Skilled - Can work independently with no supervision.
3 - Moderately Skilled - Can finish job with limited supervision.
2 - Limited Skill - Requires instruction and close supervision.
1 - No Exposure - No experience or knoledge of this area.

	Check Rating				
Clock Hrs.	1	2	3	4	Class

I HAVE READ & DISCUSSED THIS FORM WITH MY INSTRUCTOR

STUDENT'S SIGNATURE | DATE

SEE REVERSE FOR INSTRUCTOR'S COMMENTS

BEST COPY AVAILABLE

WeldTech ©. K. 1984

EXHIBIT J

SAMPLE QUALIFICATIONS CERTIFICATE

WeldTech

WELDING EDUCATION CENTER

20201 HOOVER ROAD
DETROIT, MI 48205
(313) 267-3385

CERTIFICATE

OF
TEST AND APPROVAL OF WELDING PROCESS
AND
QUALIFICATION OF OPERATOR OF WELDING EQUIPMENT

This is to Certify that WELDTECH has witnessed and tested the welding performed for:

Welding Operator _____ S. S. No. 425-04-7167

Welding Process FLUX CORED ARC WELDING

This is to certify that the welding technique used in this test and described in ANSI / AWS D1.3 -81 code for welding performance and the results of physical test complies with the requirements of the above code within the following limitations.

Base Material MILDS TEEL / GALVANIZED

Type of Weld FILLET

Maximum Plate or Wall Thickness .18

Minimum Plate or Wall Thickness .060

Welding Positions Qualified 3F (VERTICAL - DOWN)
2F (HORIZONTAL)

Other Limitations DIRECT CURRENT STRAIGHT POLARITY

WELDTECH
By Glen Knight
Glen A. Knight, Director

WeldTech

WELDING EDUCATION CENTER

20201 HOOVER ROAD
DETROIT, MI 48205
(313) 267-3385

Order No. _____

Date 7-20-84

PHYSICAL TEST REPORT OF WELDER PERFORMANCE QUALIFICATION TESTS

Client: STERLING HEIGHTS ASSEMBLY, CHRYSLER CORPORATION

Welder Name _____ S. S. No. 425-04-7167 Stamp No. 7167

Welding Process FLUX CORED ARC WELDING

Position (For vertical weld state whether upward or downward) 2F (HORIZONTAL) & 3F (VERTICAL - DOWN)
(For Plate: Flat, horizontal, vertical, or overhead; For Pipe: Axis of pipe vertical, horizontal fixed or horizontal rolled).

In accordance with Procedure Specification No. CHRYSLER SPEC.

Material – Specification Galvanized to Galvanized of P-No. 1 to P-No. 1

Diameter and Wall Thickness (if pipe) otherwise Joint Thickness .062

Thickness Range this qualifies .060 to .18

FILLER METAL

Specification No. AWS E-71T GS

Describe Filler Metal _____

Is Backing Strip Used? NO

–For Information Only–

Filler Metal Diameter and Trade Name .062 LINCOLN - INERSHIELD

Flux for Submerged Arc or Gas for Inert Gas Shielded Arc Welding NO GAS REQUIRED

Above Information by: WELDTECH [X] Client [ ] Other _____

Preparation of specimen witnessed by WELDTECH [X] No [ ]

BREAK **TEST RESULTS**

TYPE AND FIGURE NO.	RESULT	FIGURE NO.	RESULT
2F TEE JOINT	PASS	3F TEE JOINT	PASS
2F LAP JOINT	PASS	3F LAP JOINT	PASS

Test Witnessed by BRIAN BRUNN Brian Brunn Test No. _____

Results of tests (do) (~~do not~~) meet requirements of CHRYSLER OPERATION STANDARD 85-2300

Remarks Per Process Standard Fusion Welding P.S. 1682

AWS QC1 GLEN A. KNIGHT 77111211 CWI

153

125

By WELDTECH Glen Knight
Glen A. Knight, Director